BRIDGE AND BUILDING NUMBER
NOVEMBER, 1951

Railway Engineering and Maintenance

IMPROVED HIPOWERS

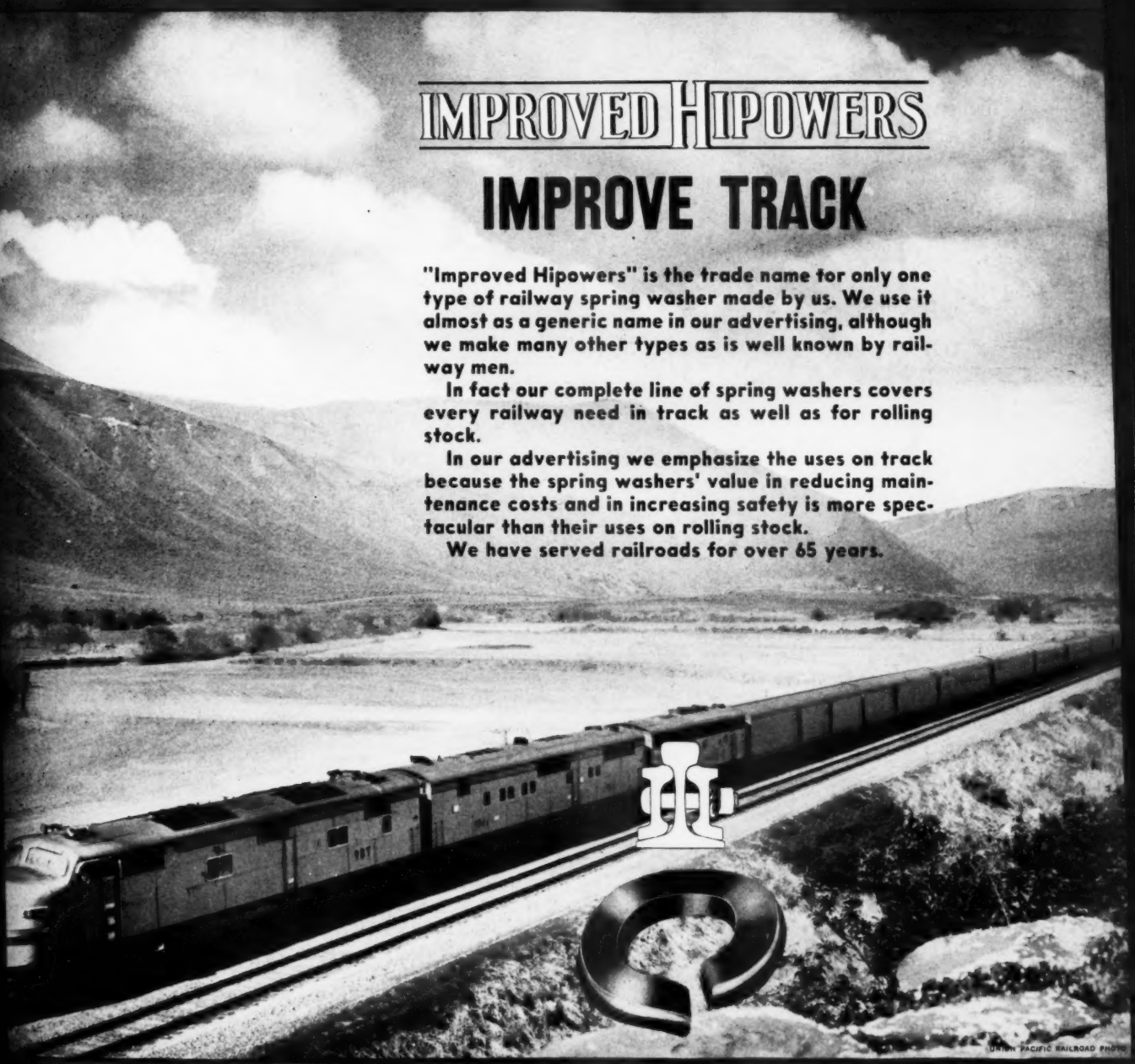
IMPROVE TRACK

"Improved Hipowers" is the trade name for only one type of railway spring washer made by us. We use it almost as a generic name in our advertising, although we make many other types as is well known by railway men.

In fact our complete line of spring washers covers every railway need in track as well as for rolling stock.

In our advertising we emphasize the uses on track because the spring washers' value in reducing maintenance costs and in increasing safety is more spectacular than their uses on rolling stock.

We have served railroads for over 65 years.



UNION PACIFIC RAILROAD PHOTO

NATIONAL LOCK WASHER COMPANY, NEWARK 5, N. J., U. S. A.

A COMPLETE LINE OF RAILWAY SPRING WASHERS

these "Maintenance Men" never sleep

When you use Reliance Hy-Pressure Hy-Crome Spring Washers on rail joint bolts, it's like having a maintenance man at each bolt ready to tighten the nut the instant looseness develops.

These "maintenance men" never sleep. Every second of every hour —day and night, winter or summer—their powerful coil-spring, reactive pressure keeps the bolted assembly under tension, instantly—automatically—"taking up" looseness resulting from wear, bolt stretch or temperature change.

They reduce the need for maintenance tightening, retard joint deterioration, cut maintenance costs and keep track open for speedy delivery of vital material for the nation's defense.

There's a Reliance Hy-Pressure Hy-Crome Spring Washer for every service condition and bolt size—scientifically designed for the particular requirements—fabricated from cold drawn alloy spring steel, uniformly heat treated to develop maximum non-fatiguing reactive force.

Try them where your maintenance problems are toughest and see for yourself why they are the choice of well-kept roads around the world.

The Edgemark Of Quality

EATON

EATON MANUFACTURING COMPANY

RELIANCE HY-PRESSURE HY-CROME SPRING WASHERS

EATON **RELIANCE DIVISION, MASSILLON, OHIO**

Sales Offices: New York, Cleveland, Detroit, Chicago, St. Louis, San Francisco, Montreal

The Rail Brace THAT STAYS TIGHT

Almost any rail brace will be tight when you first install it. But here's a brace that stays tight over the years—a brace so sturdy, so cleverly designed, that jolts, jars, and shocks can't work it loose. It's the Bethlehem No. 811.

A study of the large illustration will show how effective the 811 is. To a special tie plate is welded a strong bracing part (1). Fitting between this part and the rail is a wedge, into which is swaged a steel spring (2). The spring withstands tremendous compressive force, and the farther the wedge is driven in, the tighter the fit. Moreover, the wedge can't possibly back out, for it's locked by pawls that engage a series of vertical slots (3).

Tight as it is, however, the 811 can easily be removed when track alterations make removal necessary. Merely raise the pawls, knock out the wedge, and pull the spikes—that's all there is to it.

Why not ask for full details? A Bethlehem man will be glad to call at your convenience.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

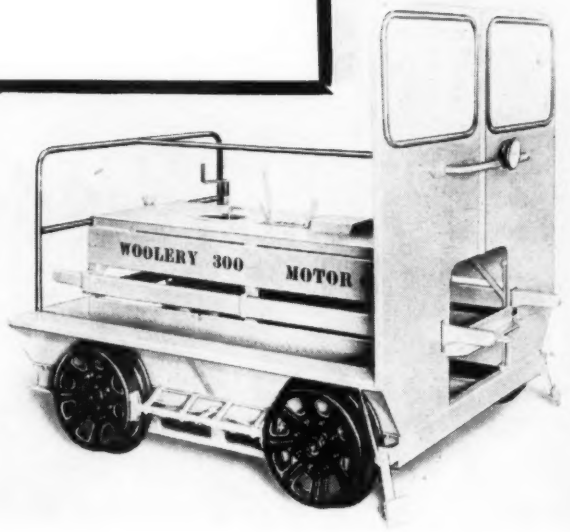
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

Published monthly by Simmons-Boardman Publishing Corporation, 79 W. Monroe St., Chicago 3, Ill. Subscription price: United States and Possessions, and Canada, one year $2.00 (special rate to railroad employees only, one year $1.00). Single copies 50 cents. Entered as second-class matter January 20, 1933, at the post office at Chicago, Ill., under the act of March 3, 1879, with additional entry at Bristol, Conn.

Our WOOLERY MOTOR CARS

*are the **least expensive,***
least temperamental,
hardest working members
of our crew!

—say maintenance men



- **4-wheel drive**
- differential when needed
- **13 H.P. air-cooled engine**
- 2-speed transmission
- **forward and reverse**
- light weight
- **heavy duty**
- pulls ten tons with ease
- **one man can lift off track**

Summer or winter, the WOOLERY 300 is the tireless, **dependable** work-horse of the gang. Low maintenance and uninterrupted service are well-known features of this rugged motor car, but its real value lies in the **easy handling** and **all-weather dependability** that has won the confidence of the men on the line!

SINCE 1917 RAILWAY MAINTENANCE EQUIPMENT

Woolery MACHINE COMPANY

2919 COMO AVE. S. E. MINNEAPOLIS 14, MINN.

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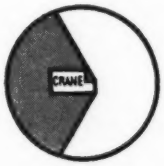
EXCLUSIVE EXPORT REPRESENTATIVES:

Pressed Steel Car Company
New York 17, N.Y.

For additional information, use postcard, pages 995-996

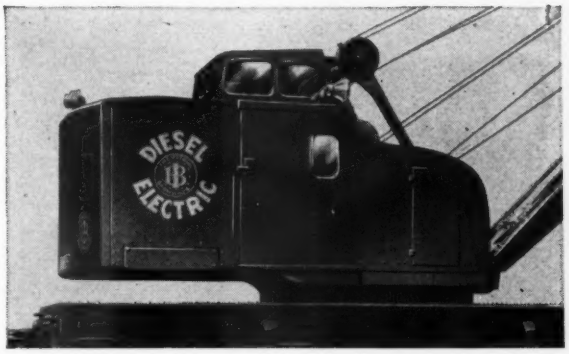
BROWNHOIST – THE ONLY LOCOMOTIVE-CRANE CAB THAT PROVIDES A CLEAR VIEW IN EVERY DIRECTION

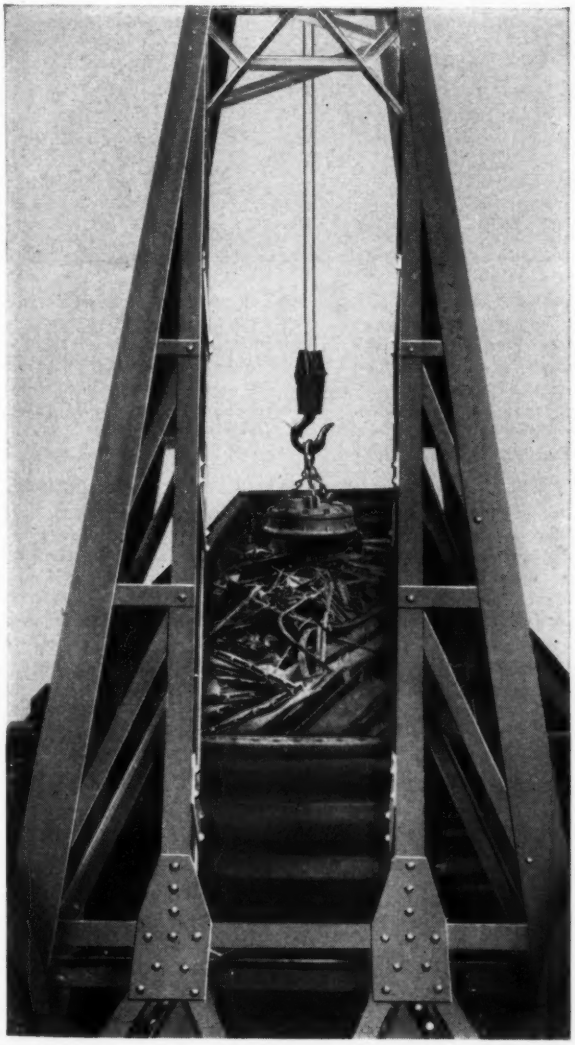
Approximate visibility from ordinary cab.



Approximate visibility with operator on side.

360 degree visibility from new Industrial Brownhoist Monitor-Type Cab.





Mounted high in the crane and surrounded by large windows, the operator in a Brownhoist patented Monitor-Type cab has full 360° visibility – forward, backward, and to both sides – providing safer operation, faster, more efficient loading and unloading. In addition the new Clear-Vision Boom is another Brownhoist feature that permits the operator an unobstructed view of his work. When unloading from high-walled railroad cars he can see right into the car.

The Monitor-Type cab is also designed for the safety and comfort of the operator. All controls are conveniently located and can be easily reached from a comfortable, well-raised seat. There's a soundproof partition between the operator and the machinery. There are doors on both sides of the cab and there's a 14″ safety clearance between car body and rotating upperworks.

Brownhoist Diesel and Diesel Electric Locomotive-Cranes are available in capacities from 20 tons up for speeding materials handling with magnet, hook or bucket. Write today for complete information.

BROWNHOIST BUILDS BETTER CRANES

INDUSTRIAL BROWNHOIST CORPORATION, BAY CITY, MICHIGAN

DISTRICT OFFICES: New York, Philadelphia, Cleveland, San Francisco, Chicago, Canadian Brownhoist Ltd., Montreal, Quebec. **AGENCIES:** Detroit, Birmingham, Houston, Los Angeles. 148

RUBBER-TIRED

LeTOURNEAU LEADERSHIP IN DOZERS

1 First LeTourneau dozer in 1926 . . . in the quarter century since that time more than 30,000 job-proved LeTourneau dozers have been built and shipped all over the world . . . far more than by any other manufacturer.

2 Universally preferred . . . almost every major dirtmoving operation around the world includes a large number of LeTourneau rubber-tired dozers . . . proof of acceptance, and ability to take punishment and help lower earthmoving costs.

3 Tournadozer was developed in 1946 . . . put 'dozing on a high-speed basis . . . eliminated track wear and maintenance costs. You travel at 19 m.p.h. from job to job . . . interchangeable attachments make it a year-round producer!

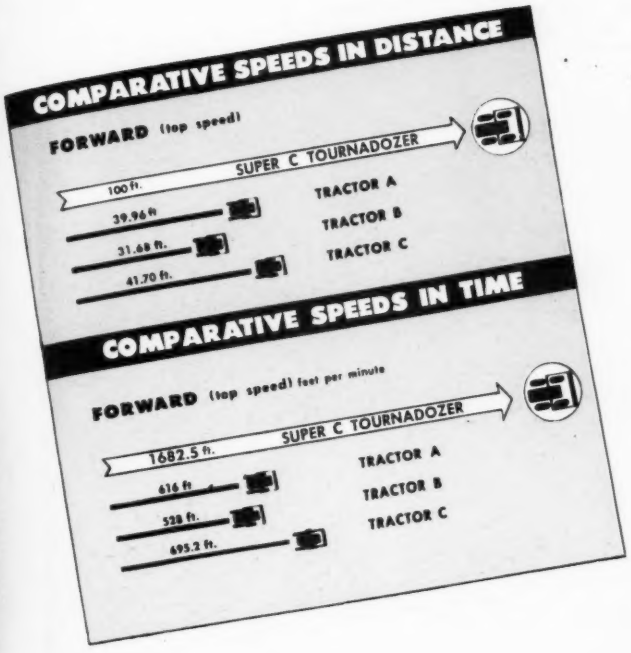
4 Reports received daily tell of outstanding performance of Tournadozers which have now been *in the field all over the world for over 4 years.* Some of these machines are operating 24 hours a day . . . seven days a week . . . year after year.

LeTOURNEAU

Tournadozer—Trademark Reg. U. S. Pat. Off. ML11rr

TOURNADOZER...

applies high speed to all dozing jobs



Le Tourneau, pioneer in the use of rubber-tired earthmoving equipment, has long realized the need for a high-speed, high-production dozer . . . a machine built as a unit that would overcome limitations of the slow-moving, crawler-tractor dozers. The Super C Tournadozer is LeTourneau's answer. It is fast, mobile and powerful, incorporating new highs in speed, maneuverability, visibility. It's an all-surface, all-weather tool that goes anywhere . . . right now!

Tournadozer is revolutionary because its working principle is completely new and different. It is the FIRST heavy-duty dozer on rubber designed as a unit specifically for high-speed, high-production, and lower-cost dozer work.

It applies 186 h.p. to 4-wheel drive on 21.00 x 25 low-pressure tires . . . gets more work done in less time, gets to the next job faster. Tournadozer goes anywhere via highway, down the tracks, across yards, or along the right-of-way . . . does not tie up work-train equipment or delay train traffic, needs no train orders, no extra manpower for stand-by crews. One-man operated Tournadozer becomes a complete and independent work unit.

Tournadozer's powerful 4-wheel drive gives almost 3 times the forward speed, plus reverse speeds far faster than most crawlers. Constant-mesh, "instant-shift" transmission eliminates time-consuming stops for gear changing. No loss of rolling momentum. Torque converter available to automatically apply the engine's 186 h.p. most effectively and smooth out shock loads.

Tournadozer's 100% mobility means that you now can work or travel anywhere. Hauling costs and loading delays are eliminated. An assignment a half mile away can be started in just a couple of minutes from "now."

Tournadozer's high speed, job versatility and 100% mobility will take care of more job assignments per day with fewer units. Each assignment is more quickly completed. On many applications a single Tournadozer often does work of two, sometimes three, crawler dozers. On pusher service, Tournadozers complete loading faster, position for next push more quickly, can easily service a larger fleet of scraper units.

R. G. LeTOURNEAU, INC.

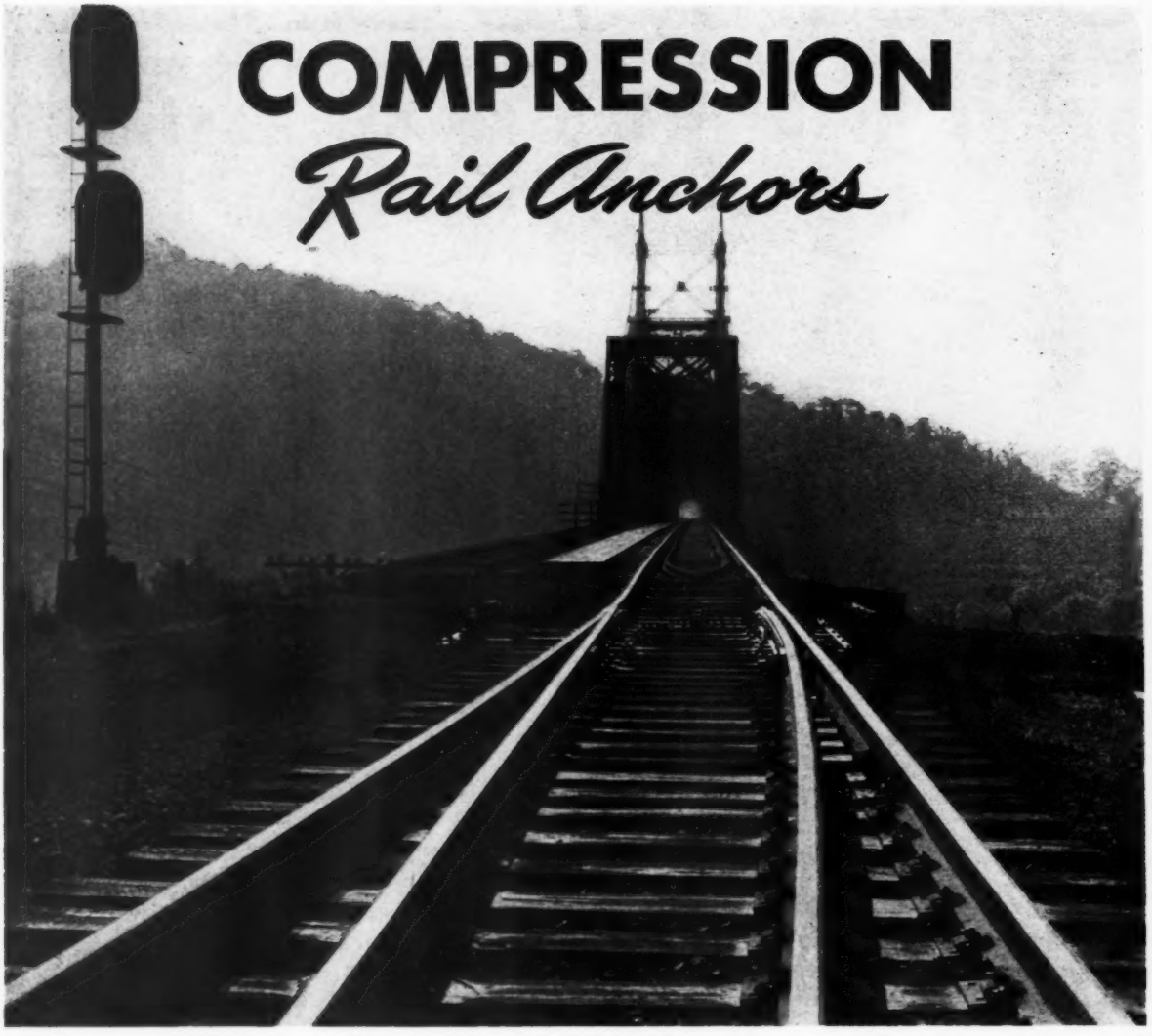
PEORIA, ILLINOIS

NOW!

Write for bulletin giving specific description of TOURNADOZER and reasons why it can get more work done faster on your railroad

• HAULING • LIFTING EQUIPMENT

COMPRESSION
Rail Anchors



On a wide variety of bridge and viaduct jobs throughout the country, you find *two-way holding* Compression Rail Anchors. Their efficient and economical protection has won significant recognition.

THE RAILS COMPANY

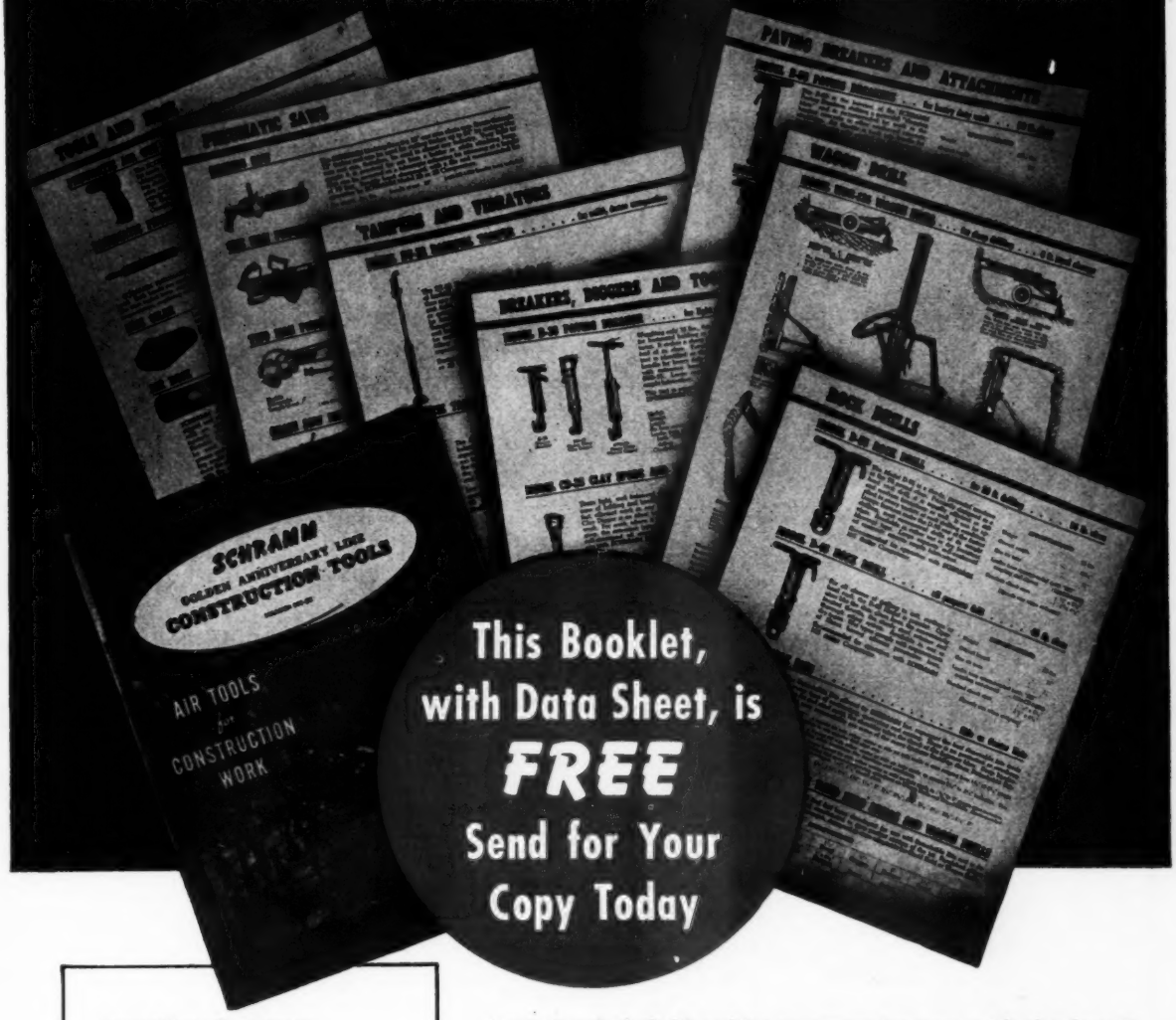
General Office
178 GOFFE STREET, NEW HAVEN 11, CONN.

ST. LOUIS, MO. HOBOKEN, N. J. CHICAGO, ILL.

For additional information, use postcard, pages 995-996

VALUABLE INFORMATION

ON HOW TO SELECT THE RIGHT AIR TOOLS



This Booklet, with Data Sheet, is *FREE*

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Partial list of contents:

- Rock Drills
- Wagon Drills
- Paving Breakers
- Sheeting Drivers
- Track Spike and Form Pin Drivers
- Clay Spades and Trench Diggers
- Backfill Tampers
- Tie Tampers
- Vibrators
- Pneumatic Chain Saws
- Pneumatic Circular Saws
- Hose and Accessories

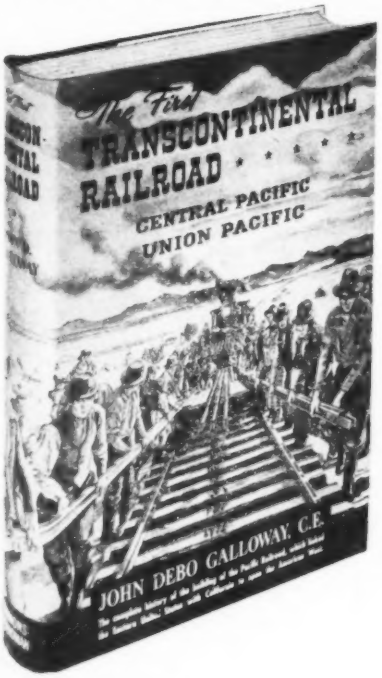
Here is a helpful booklet to acquaint you with the latest designed SCHRAMM Air Tools — Tools for every Compressed air use. It is fully illustrated, giving design features which will show you why these tools perform smoothly, easily, yet powerfully.

You will find many uses for this booklet, so we urge you to write today for your free copy of SCT-50Z.

SCHRAMM INC.

The Compressor People • **WEST CHESTER • PENNA.**

The First TRANSCONTINENTAL RAILROAD



By JOHN D. GALLOWAY, C.E.

The construction of the Union Pacific and Central Pacific railroads linking Omaha with Sacramento was the crowning achievement of the railroad era. It was considered by the author the greatest engineering project of the Nineteenth Century.

The author for more than forty years was a leading consulting engineer of San Francisco. He was thoroughly familiar with the original routes of both railroads. While gathering manuscript material he carried on an extensive correspondence with relatives of the builders. Many of the authentic photographs showing construction methods were from his private collection.

The individual contributions of railroad engineers, construction company heads and railroad officials who had a part in this great project are objectively appraised. Biographical sketches of the more prominent engineers and railroad builders of the era are included.

Contents

The Pacific Railroad—The Origin and Development of Railroads Prior to 1870—Early Projects and the Pacific Railroad Surveys—The Builders of the Central Pacific Railroad—The Central Pacific Railroad Company—Locating the Central Pacific Railroad—Constructing the Central Pacific Railroad—The Builders of the Union Pacific Railroad—The Union Pacific Railroad Company—Locating the Union Pacific Railroad—Constructing the Union Pacific Railroad.

320 pages, 73 photographs, 4 maps, bibliography, index

$5.00

Reviews

"The story of these railroads had been told many times. However, few authors approached the Herculean project with the same appreciation of the problems involved as has Galloway. You are left with the firm belief that building this first transcontinental railroad was truly the greatest engineering feat of the 19th Century."—**Engineering News-Record.**

"At Promontory, Utah, there stands a great stone monument to the **Last Spike** which joined the two branches of this nation's first cross-continental railroad. The story of the Central Pacific's long trek over the Sierras from Sacramento eastward and of the corresponding labors of the Union Pacific's workers who worked west from Omaha is one of the greatest chapters of nineteenth-century progress. This story, this epic of Americana, is told from the viewpoint of a civil engineer."—**The Argonaut.**

"Galloway rates as one of the great engineers who had an important part in the development of Western America. As an authoritative record of one of the nation's greatest engineering achievements, his book is a basic contribution to the literature of American railroading."
Southern Pacific Bulletin.

TEN DAYS' FREE EXAMINATION

Simmons-Boardman Publishing Corporation
30 Church Street, New York 7, N. Y.

Please send me on Ten Days' Approval a copy of Galloway's FIRST TRANSCONTINENTAL RAILROAD, $5.00. If satisfactory I will remit the list price; otherwise I will mail back the book

Name .....

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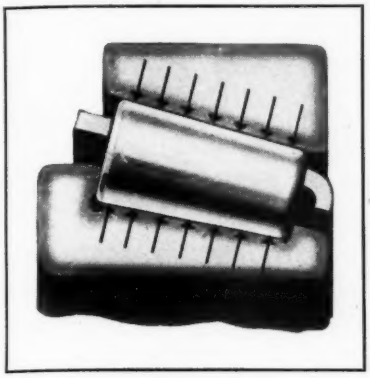
City ..... Zone ..... State .....

Company ..... Position .....

R. E. & M. 11-51

What's your bearing problem?



HEAVY LOADS?

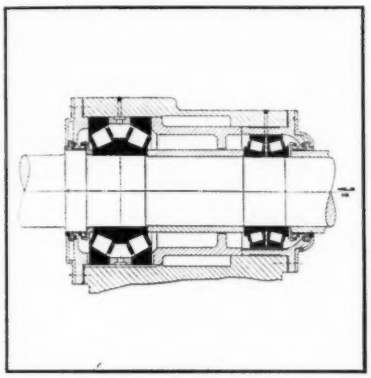
In Timken® bearings the load on rollers and races is spread evenly over a line of contact. The greater load area means extra load-carrying capacity.

COMBINATION LOADS?

Because they're tapered in design, Timken bearings carry both radial and thrust loads. Auxiliary thrust bearings or plates are eliminated.

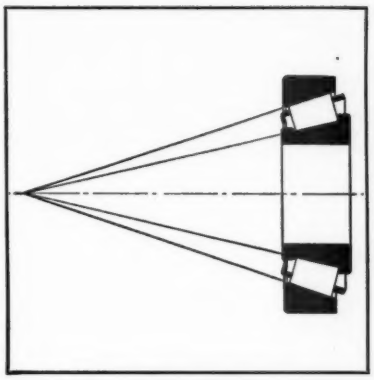
PRECISION?

Timken bearings hold shafts in proper alignment. Gears mesh with precision, assuring a smooth flow of power. Deflection is minimized, end-movement prevented.



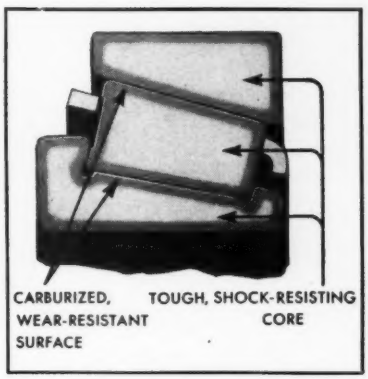
MAINTENANCE?

Closures are more effective because Timken bearings keep housing and shaft concentric. Dirt and grit are kept out, lubricant kept in.



FRICTION?

Timken bearings roll freely due to true rolling motion. All lines coincident with the tapered surfaces of the rollers and races meet at a common point on the bearing's axis.



WEAR?

Rollers and races of Timken bearings are made of Timken fine alloy steel—case hardened to give them a hard wear-resistant surface and a tough shock-resisting core.

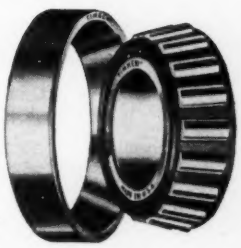
TIMKEN® bearings solve them all!

Be sure to specify Timken roller bearings for the machines you build or buy. Look for the trademark "TIMKEN" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

TIMKEN

TRADE-MARK REG. U.S. PAT. OFF.

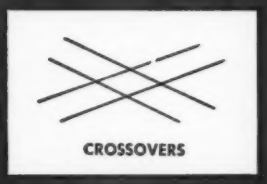
TAPERED ROLLER BEARINGS



NOT JUST A BALL NOT JUST A ROLLER THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION

Speed up toughest tamping jobs!

—For a better job in less time at fixed elevations like these: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NEW HEAVY DUTY MT8 AIR TAMPING GUN

COMPACT! EASY-HANDLING! EXTRA POWERFUL!

The new MT8 Tamping Gun, developing twice the power of standard tamping guns, is specifically designed to do today's tougher tamping jobs faster. Heavier rails, longer ties and increased traffic make tighter tamping a must—and tighter tamping calls for this more powerful MT8.

The new MT8 Tamping Gun is easy to hold, uses standard steels, and is exceptionally light for the power developed. Its air consumption is low—two guns can be operated from the compact, highly portable 3R36 Spot-Air Compressor.

Get the details on the complete Ingersoll-Rand Tie Tamping Team—the new heavy duty MT8 Tamping Gun, the standard MT4 Tamping Gun, and the 3R36 Spot-Air Compressor. Write or call your nearest I-R Branch Office today.

Two MT8's make short work of tamping this heavily-used crossover

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Look To The First — For The Finest

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • DIESEL AND GAS ENGINES

NOW! when maintenance costs more than ever...

Penta* Protected WOOD PAYS OFF!

Keep your stock rolling with a minimum of maintenance . . . use PENTA! When you protect car lumber—and *all* lumber with PENTA . . . you cut maintenance costs by giving wood longer, more dependable life.

For years to come, PENTA will protect wood against termites and decay . . . will give wood greater serviceability and longer life. And your maintenance crews will find PENTA-PROTECTED wood is clean and easy to handle.

PENTA-PROTECTED wood costs you *less per year.* This saving is proved by railroad service records which show treated wood lasts three to four times longer than untreated wood.

Protect your investment in wood . . . use PENTA-PROTECTED wood not only for car lumber but also for poles, loading platforms, all wood buildings and other wood construction. For more information about this sound investment, write Dow, Dept. PE-46A, for free booklet, "Pointers on Penta."

INVESTIGATE Penta THE CLEAN WOOD PRESERVATIVE

will not leach . . . can be painted over

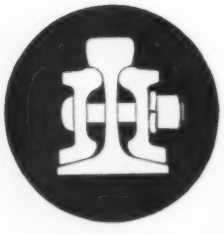
*PENTA is a popular abbreviation of the name of the chemical, PENTAchlorophenol.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

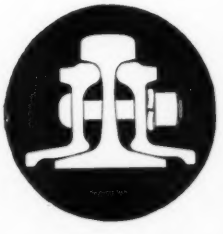
DOW
Penta
chlorophenol

IMPROVED RAIL SECTIONS

Need the Best in

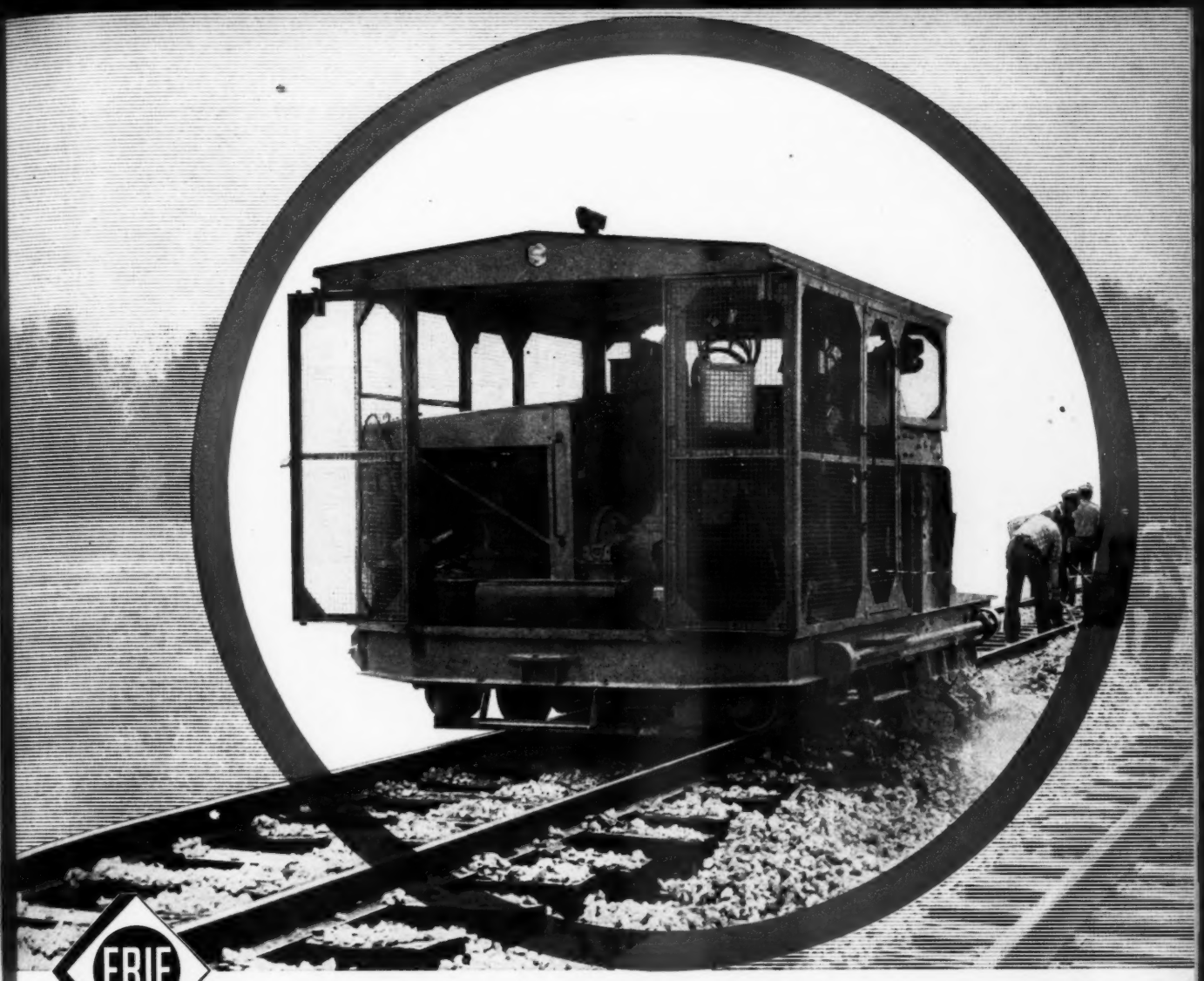


RAIL JOINTS



THE RAIL JOINT COMPANY Inc.
50 CHURCH ST. NEW YORK 7, N. Y.

For additional information, use postcard, pages 955-996



ERIE

...another road that can show you why your best maintenance of way investment is a Power Ballaster.

"Lower Costs per tamped foot

THAN WE HAVE EVER BELIEVED POSSIBLE"

Practically any railroad can experience big reductions in track maintenance costs after once using the Power Ballaster. Why?

On the Erie Railroad, for example, Power Ballasters tamp an average of 3000 feet per 6½ hour day... 461 feet per hour! Blair Blowers, Chief Engineer, Maintenance of Way, speaks with authority on the results of this kind of tamping:

"... because of this machine's exceptional production rate, lower labor requirement, and powerful triple-action compaction, we get a lower cost per tamped foot than we had ever believed possible."

The Erie is one of many roads which kept records that conclusively prove one fact: mile after mile you get lower cost tamping and higher quality track with the Power Ballaster! Let an experienced Power Ballaster Representative show you how you can make savings in your track maintenance. Write us today.

TRACK AT ITS LEVEL BEST... AT THE LOWEST COST

Here's what YOU can expect from the POWER BALLASTER

Triple-Action Compaction—Tamps down, then under, then up—for an under tie ballast foundation that fully meets AREA standards.

Low Labor Requirement—Easily handled with as little as two 5-man gangs.

High Production at Low Cost—450 to 750 feet of tamped track per hour often pays for the Power Ballaster in one season.

Versatility—Tamps raises from 0" to 8" on rail of any weight, with any ballast.

Maximum Use of Track Time—Powered jacks permit 4 men to make lateral set-off in 3 to 5 minutes... 25 MPH speed for fast runs to siding, crib or work locations.

POWER BALLASTER PRODUCTS DIVISION

Pullman-Standard

CAR MANUFACTURING COMPANY

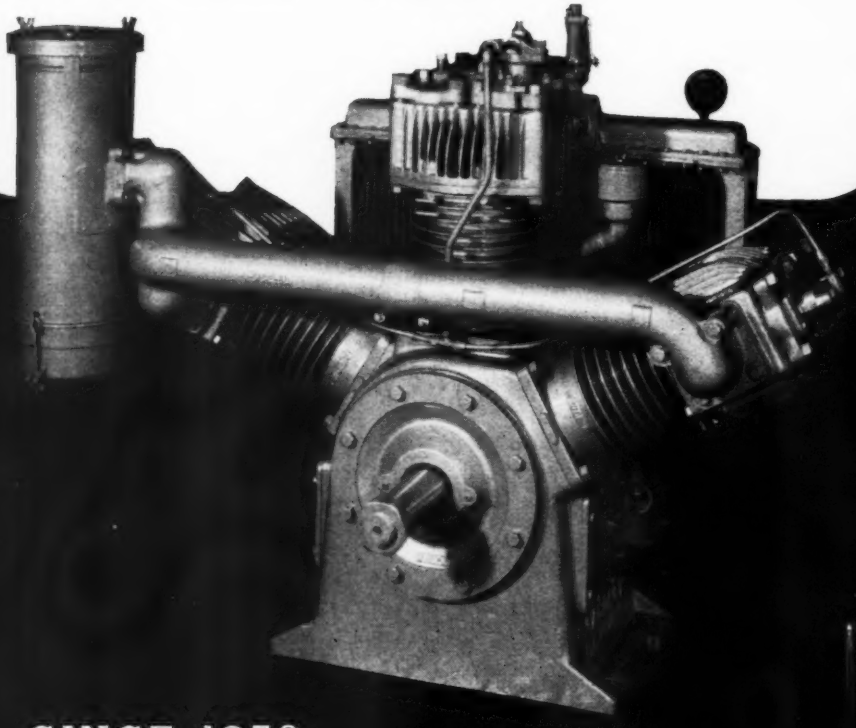
BIRMINGHAM • CLEVELAND • PITTSBURGH • NEW YORK • SAN FRANCISCO • WASHINGTON

Your locomotive builder

services your GARDNER-DENVER compressors

You don't have to have a special setup to insure prompt, expert servicing for Gardner-Denver WX Air Compressors on your locomotive units. Your locomotive builder has complete service facilities for keeping these quality compressors in top-notch condition — carries a complete stock of parts. You get dependable compressor service from the same source you normally use for locomotive service.

That's one big reason why it pays railroaders to insist on Gardner-Denver WX Compressors. Some other reasons are: high availability — smooth operation — accessibility — and sustained efficiency.



SINCE 1859

GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois
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THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS

YOUR **EXTRA EMPLOYEE** THAT WORKS WITHOUT PAY

RACINE *Portable* RAIL DRILL

- LIGHT IN WEIGHT -- 165 lbs.
- EASY TO HANDLE
- POWERFUL -- FAST
- FITS ALL RAILS
- AUTOMATIC POWER FEED

See this modern, gas-engine powered rail drill. A machine built to machine tool precision standards. It is a rugged, accurate drill press on horizontal lines.

Light in weight, mounted on rollers, without outboard supports, this machine can be handled and operated by one man. Husky, quick-acting clamps hold the machine securely on the rail and provide quick removal to clear traffic. Finished holes can be produced in one to two minutes depending on drill size and web thickness. Handles all size drills. Special type *automatic power feed* insures a predetermined drilling time per hole. Definite output per man-hour can be established. Write today for Free 3-color catalog.

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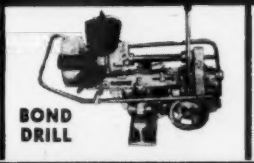

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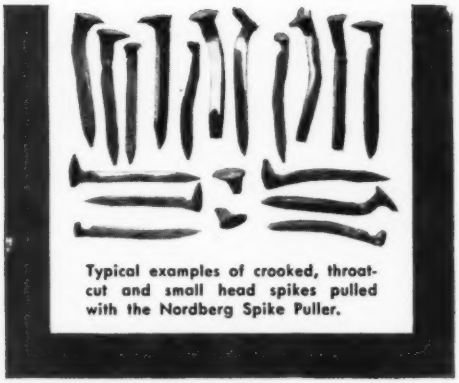

Typical examples of crooked, throat-cut and small head spikes pulled with the Nordberg Spike Puller.

Save Time and Money with the NORDBERG SPIKE PULLER

Features:

- PULLS FROM 30 to 45 SPIKES PER MINUTE.
- PULLS SPIKES ON BRIDGES, GUARD RAIL, SWITCHPOINTS—EASIER, SAFER.
- SELF-CONTAINED UNIT . . . 6 H.P. AIR-COOLED ENGINE EXERTS 12,000 POUNDS UPWARD PULL.
- PULLS SPIKES STRAIGHT—GREATER SALVAGE VALUE.

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Write for complete details covering this time and money-saving Nordberg Maintenance Machine.

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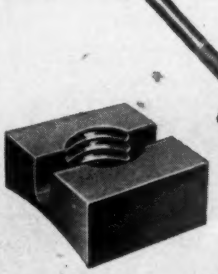

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Sealtite Car Bolt

Sealtite Slotted Head Car Bolt

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Sealtite Bolts available with Loktite Nut #2, washer nut, or std. sq. and hex. nuts.

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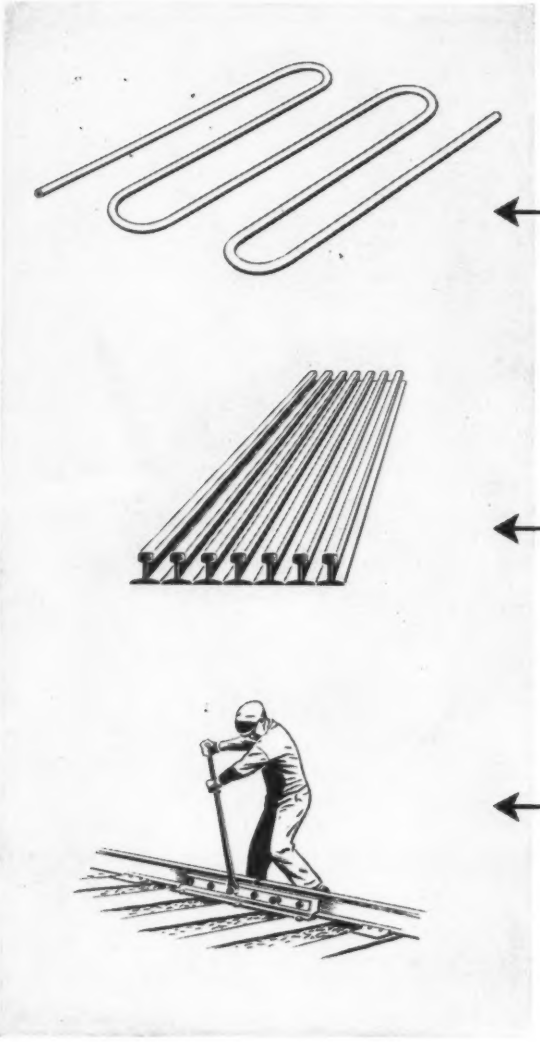
Saves these Critical Railroad Needs...



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Signal bonds of average size weigh 2½ ounces. In a mile of RIBBONRAIL track you save 30 pounds of scarce, costly copper – enough copper to make 147 ft. of ½ in. standard copper tubing. When you use continuous rail you also save copper in the future because there are no bond renewals in RIBBONRAIL.

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With every mile of track laid with RIBBONRAIL you make a net saving of from 12 to 16 tons of steel – enough steel to lay more than 300 ft. of track with RIBBONRAIL. And in the future you save more steel because with RIBBONRAIL no standard lengths are removed because of battered rail ends. Put essential steel to use in rail – not in joint fastenings.

MANPOWER

RIBBONRAIL is easily installed with few men. And it eliminates joint bar maintenance – there are no fastenings to tighten and replace, no joint lubricant to apply, and no battered rail ends to build up. All these major manpower users are eliminated. Use your valuable manpower for other operations.

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The True Temper Rail Anchor has the same quality of durability. It's easy to apply, easy to remove and re-apply when necessary. It carries the ball as many times as called on.

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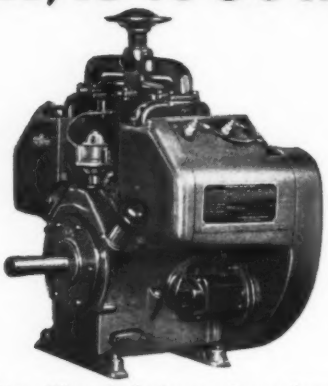
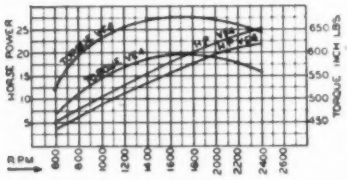
In The Top Bracket Power Range V-Type 4-Cylinder WISCONSIN *Air-Cooled* ENGINES, 15 to 30 hp.

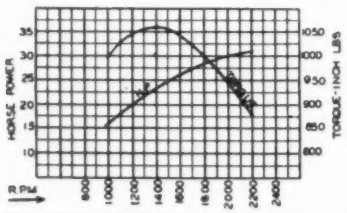


VE4, VF4, and VP4D, V-type, 4-cylinder standard engines, 15 to 30 hp.

These 4-cylinder, V-type Wisconsin Engines meet every heavy-duty power requirement. V-type design assures not only the smoothest power delivery but also represents substantial reductions in engine weight as well as extreme compactness . . . at no sacrifice of rugged construction.



In addition to dependable, all-weather air-cooling, these engines have such features as self-cleaning tapered roller bearings at both ends of the crankshaft, rotary type high tension magneto mounted on outside of engine . . . and provide maximum torque at usable speeds (most desirable for equipment that really has to go to work).



POWER CURVE AND HORSEPOWER LISTING SHOWS MAXIMUM DYNAMOMETER HORSEPOWER OF ENGINE complete with fan, muffler and air cleaner. For continuous heavy-duty operation, do not rate the engine at more than 80% of the horsepower shown at any given speed.

MODELS	VE4	VF4	VP4D
Bore.....inches	3	3¼	3½
Stroke.....inches	3¼	3¼	4
No. of cylinders.....	4	4	4
Displ. cubic inches.....	91.9	107.7	154
H.P. and R.P.M. range.....	15 at 1600	17.5 at 1600	26.8 at 1600
	21.5 at 2400	25 at 2400	31 at 2200
Net weight in lbs., Standard Engine....	295	295	410
Standard engine, side-mount tank.....	315	315	430
Standard power unit.....	355	355	470
Added weight for clutch.....	40	40	90
Added weight for reduction.....	70	70	.....
Added weight for clutch reduction.....	90	90	135

Write for detailed data and name of nearest Wisconsin distributor.

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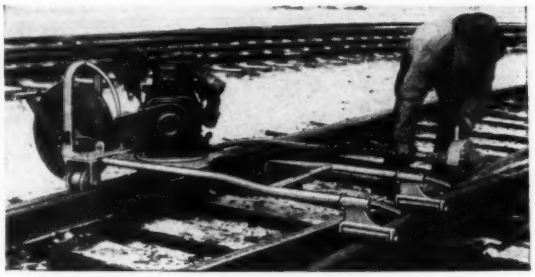

the RTW P-44 Track Grinder

Speed . . . Power . . . Economy . . . work hand in hand with your track gang when you equip them with a P-44 Track Grinder. Look at these many advantages:

- Grinder's 360° swivel engine mount prevents short bends and kinking of flexible shaft.
- Clutch assembly in the engine protects shaft from overload.
- Three position wheel clears switches and crossovers easily. Quickly adjusted for off track use.
- Light and compact, it gets on and off the track fast. Can be used under heavy traffic.
- Quickly adaptable for auxiliary equipment: Straight Wheel Hand Piece, Angle Hand Piece for Cup Wheel, Cross Grinder Guide and Track Drill.

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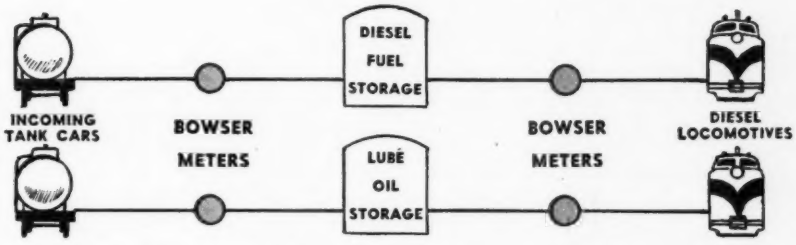
WHERE'D ALL THAT OIL GO?

This storekeeper is honest as the day is long . . . careful as the best accountant . . . ***but the cards are stacked against him.*** Why? Because he depends on "guessing" sticks or tank gauges for his inventory records! Tank gauges show only what's on hand . . . approximately. They don't tell what you received (to the gallon) and they can't accurately show how much goes into each diesel.

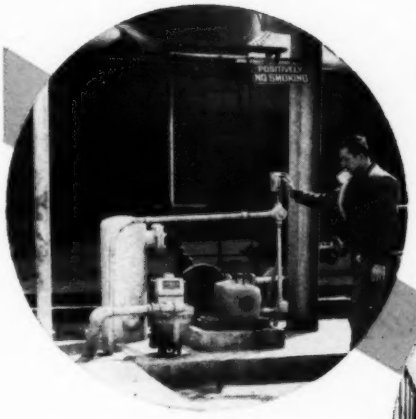
HERE'S HOW TO CONTROL INVENTORIES



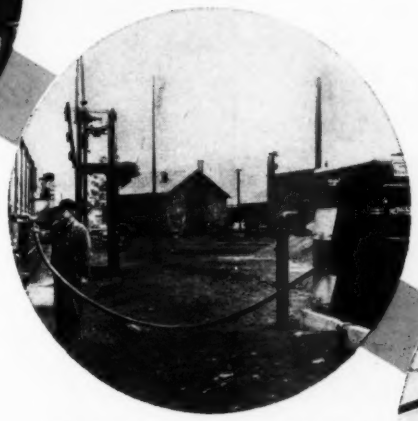
BOWSER METERS GIVE YOU THESE FACTS... RIGHT ON THE BUTTON!

They uncover any receipt shortages or overages . . . to the gallon. They charge each locomotive serviced with the exact amount of fuel and lube oil . . . provide dependable cost records. They also disclose petty pilferage or mistakes.

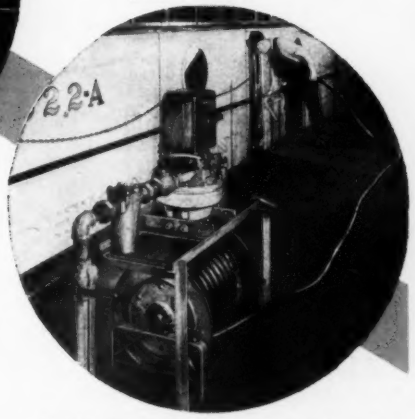
● Fuel and lube oil consumption records for diesel locomotives are made automatically with Bowser ticket printer meters.



Bowser meters accurately check incoming liquids.



Hi-Speed, one-package diesel fueling at 100 g.p.m.



Double-Quick, Bowser-metered lube oil service saves time.

A Bowser inventory control specialist is available to consult with you. May he call?

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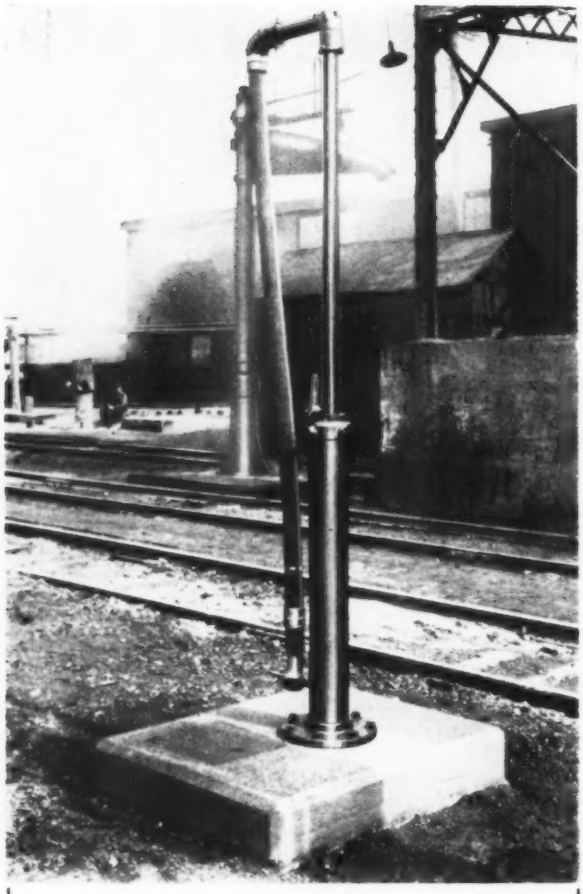
BOWSER ESTABLISHED 1885

LIQUID CONTROL SPECIALISTS SINCE 1885



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Water Columns
for servicing Diesel locomotives

Two outstanding features of the POAGE Diesel Water Columns are:

1. **Incorporation of the POAGE Water Hammer Eliminator in the valve chamber; prevents damaging water hammer in the supply line after the valve is shut off.**
2. **Draining of vertical column after service; eliminates necessity of costly frost boxes around the exposed section of the vertical column to prevent freezing.**

POAGE Diesel Water Columns have been operated in sub-zero temperatures with continuous satisfactory performance.

The upper end of the vertical column is equipped with a swivel point to permit watering of Diesels on parallel tracks. The outer end of the extended arm is also equipped with a swivel joint, so the hose may be pulled to full length without danger of kinks.

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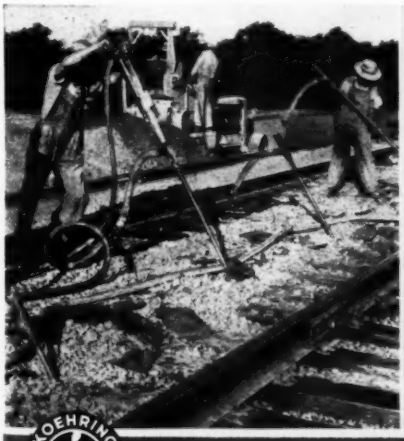
All-welded, box-type shovel boom and double dipper sticks . . . plus torsion-resistant shipper shaft mounted on top of deep boom mid-section . . . withstand twists and strains of heaviest digging. One-piece chain, inside boom, gives powerful, positive crowd. Big booster clutch cuts normal lever pull over 50%, reduces operator fatigue . . . yet retains "feel" of load. Heat compensator spring makes tension changes automatically, maintains full clutch efficiency at all times.

Koehring 304 lifts 13.9 tons on crawlers . . . up to 25 tons on rubber-tired truck or cruiser mounting. Other Heavy-Duty sizes lift up to 79½ tons . . . have dipper capacities to 2½ yards.



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stabilizes track beds without interrupting rail traffic. Injection points are driven into water or ballast pockets in sub-grade . . . hydraulic pump forces soil-cement slurry into weakened area, stabilizing existing material . . . leaves firm, lasting sub-grade.

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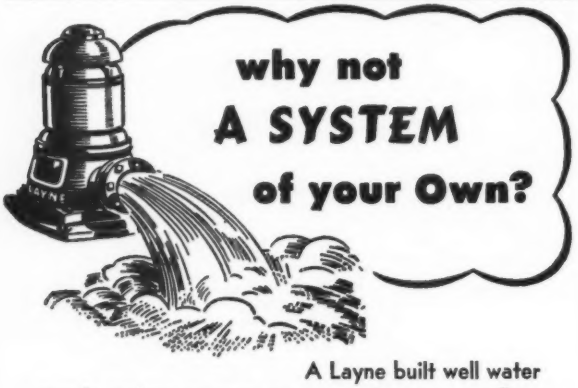

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Of Railway Engineering and Maintenance published monthly at Chicago, Illinois, for October, 1951.

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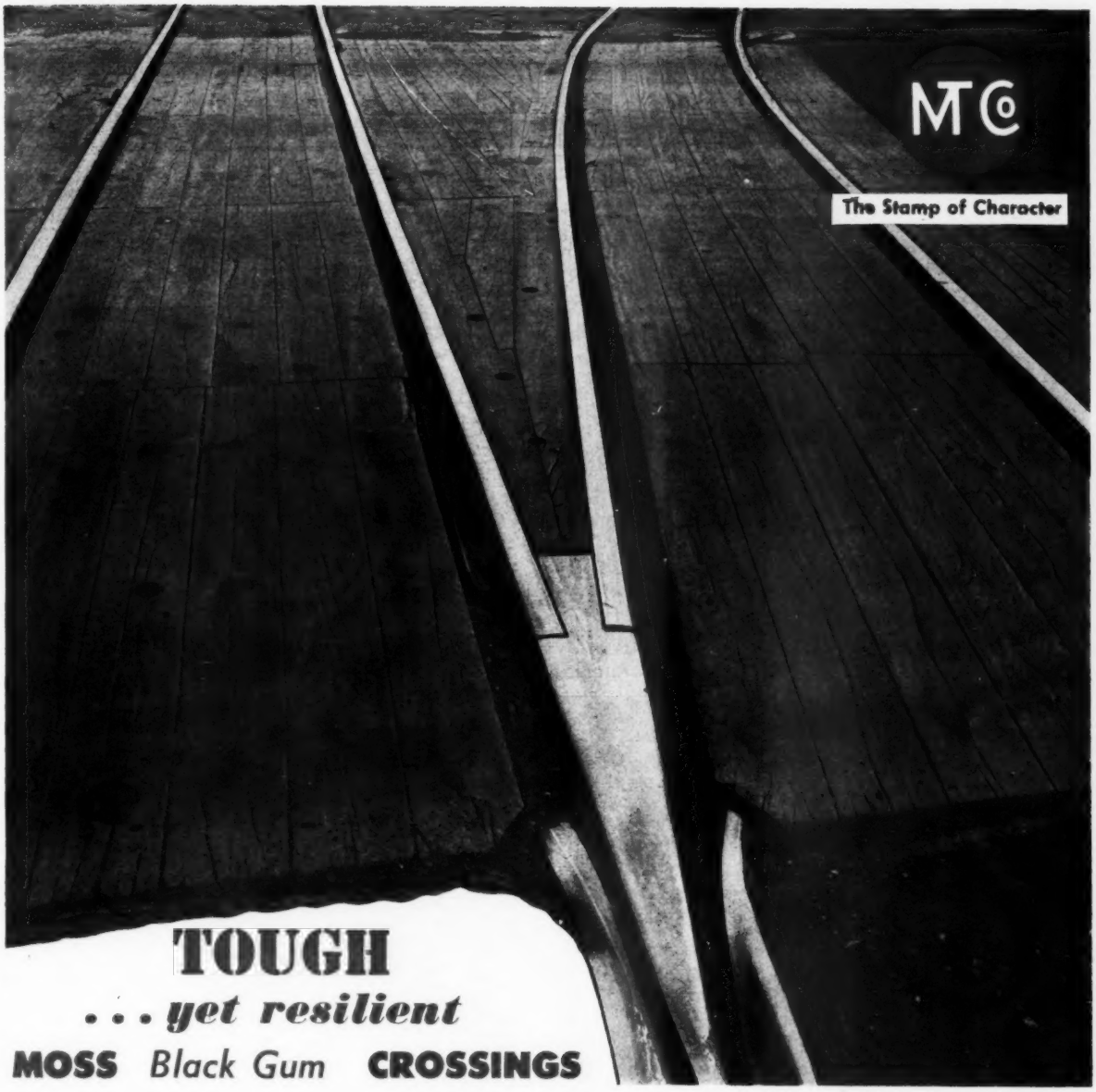
(My commission expires February 3, 1953.)



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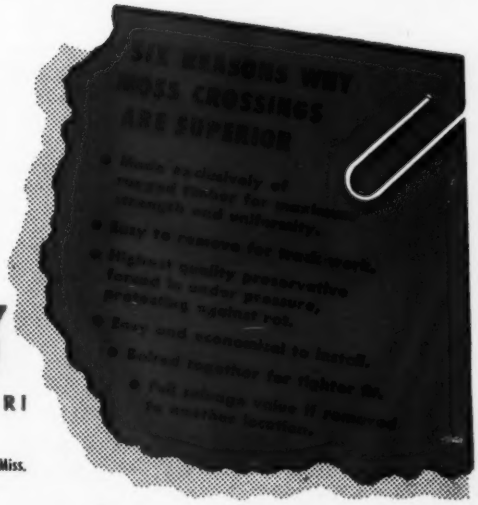

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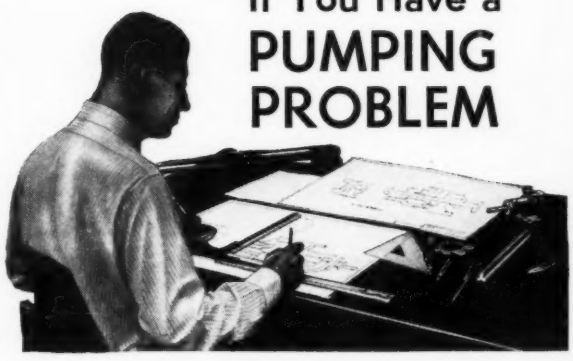

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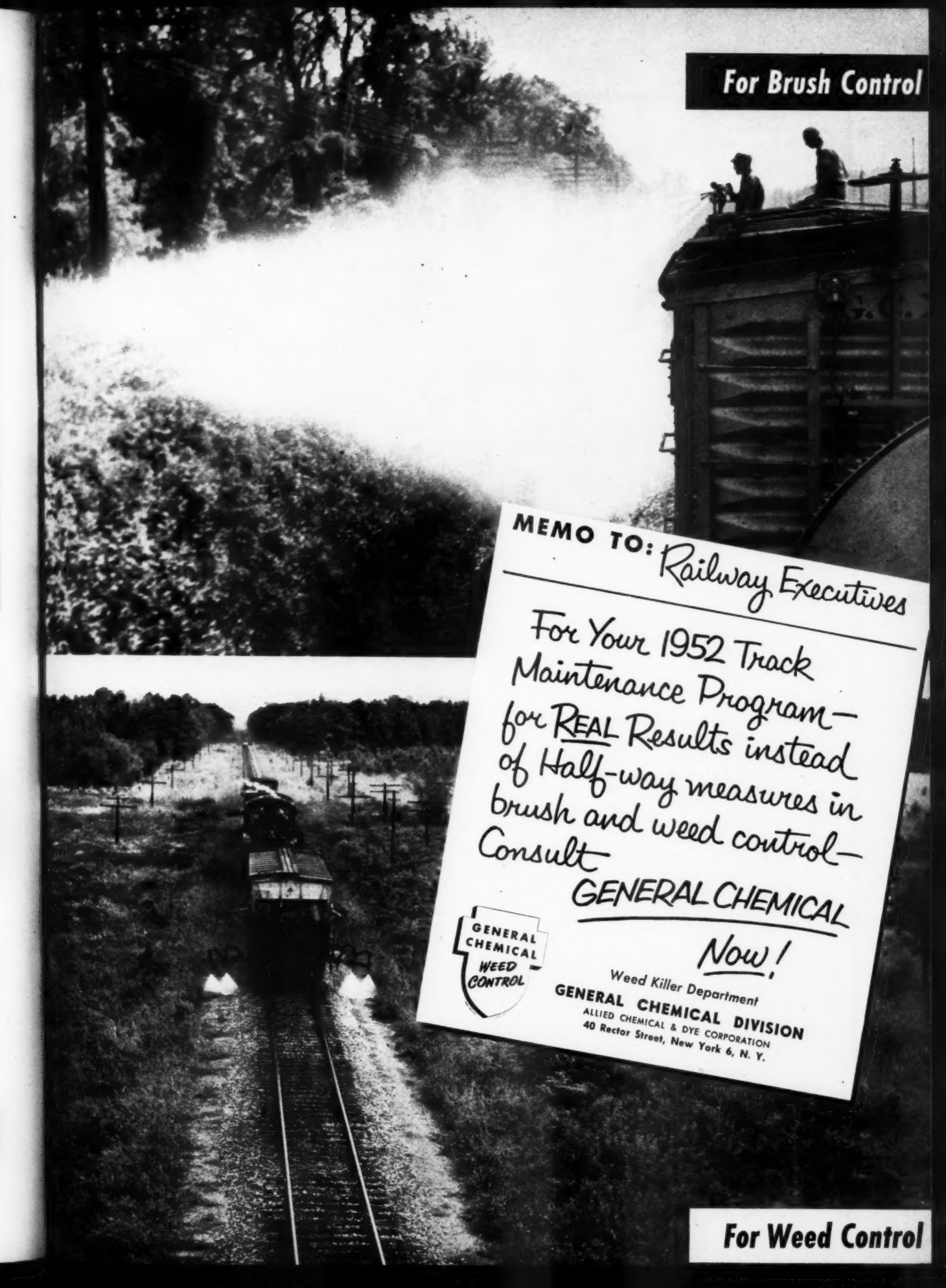
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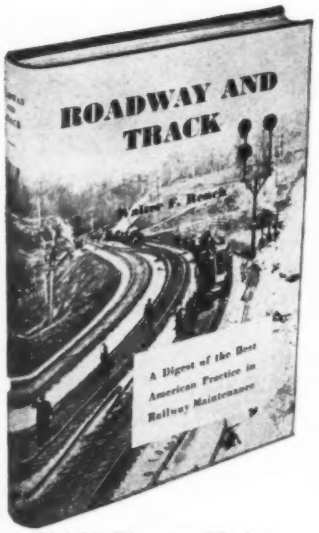

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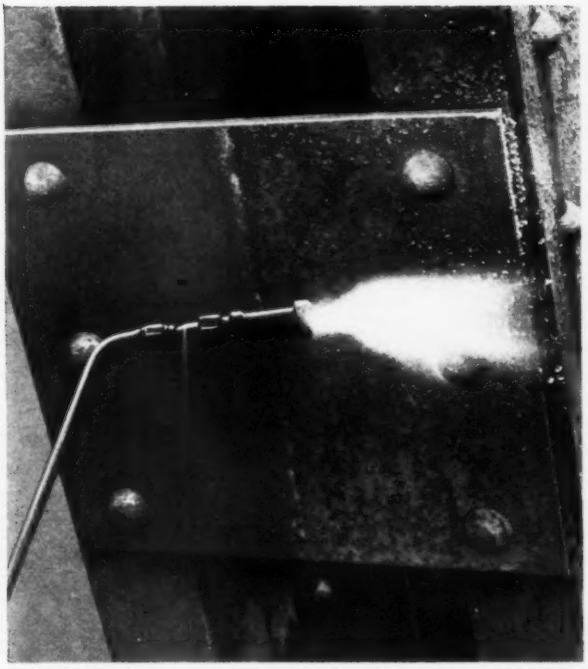

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Products Index

A

Air Compressors 969, 972, 976, 982
Air Tools 969, 972
Aluminum Jacks 1048, 1050
Anchors 968, 981, 1041
Asphalt 1060
Asphalt Flooring 990
Axes 981

B

Backfill Tampers 969
Ballast Cleaners 997
Ballast Cleaning Service 994
Ballast Coatings 1060
Ballast Forks 981
Bearings, Roller 971
Bolts 979
Bond Drills 977
Braces, Rail 963
Bridge Flooring 1052
Bridge Hardware 979
Brooms, Rotary 1044
Brush Killers 991, 1057
Brush Killing Service 1039
Brushes 1001
Bulldozers 966, 967, 988, 1044

C

Centrifugal Pumps 972
Chain Saws 969, 982, 1042
Chemical Weed Killers 1047, 1057
Chemicals 1031, 1047
Compromise Joints 990
Concrete Deck Slabs 986
Concrete Products 986
Condensers 972
Continuous Rail 986
Corrugated Metal Pipe 1052
Cranes 965, 982, 985, 1049, 1056
Crawler Cranes 985
Crawler Tractors 987
Cribbing, Concrete 986
Cross Ties 989
Culvert Liners 998
Culvert Pipe 998
Culvert Pipe, Concrete 986

D

Dehydrators 983
Diesel-Electric Locomotive Cranes 965, 1049
Diesel Fuel Dehydrators 983
Ditchers 966, 987
Drafting Equipment 1054
Drills 969, 972, 973, 977

E

Earthmoving Equipment 966, 967, 987, 988, 1045
Electric Power Plants 988
Electric Tie Tampers 969
Electric Tools 982
Emulsified Asphalt 1060
Engines, Diesel 972, 983
Engines, Gasoline 973, 983

F

Fastenings 1031
Flame Cleaning Equipment 994
Floor Surfacings 990
Flooring 1052
Frog Grinders 991
Front-End Loaders 966
Fuel-Oil Dehydrators 1048

G

Gasoline Engines 973
Glass 1001
Graphite 1054
Grinders 982, 1001
Grouting Equipment 994

H

Hammers 981
Hatchets 981
Highway Crossings 1062
Highway Guard Rails 1062
Hook Bolts 979
Hoses 983

Railway Engineering and Maintenance ..... November, 1957 943

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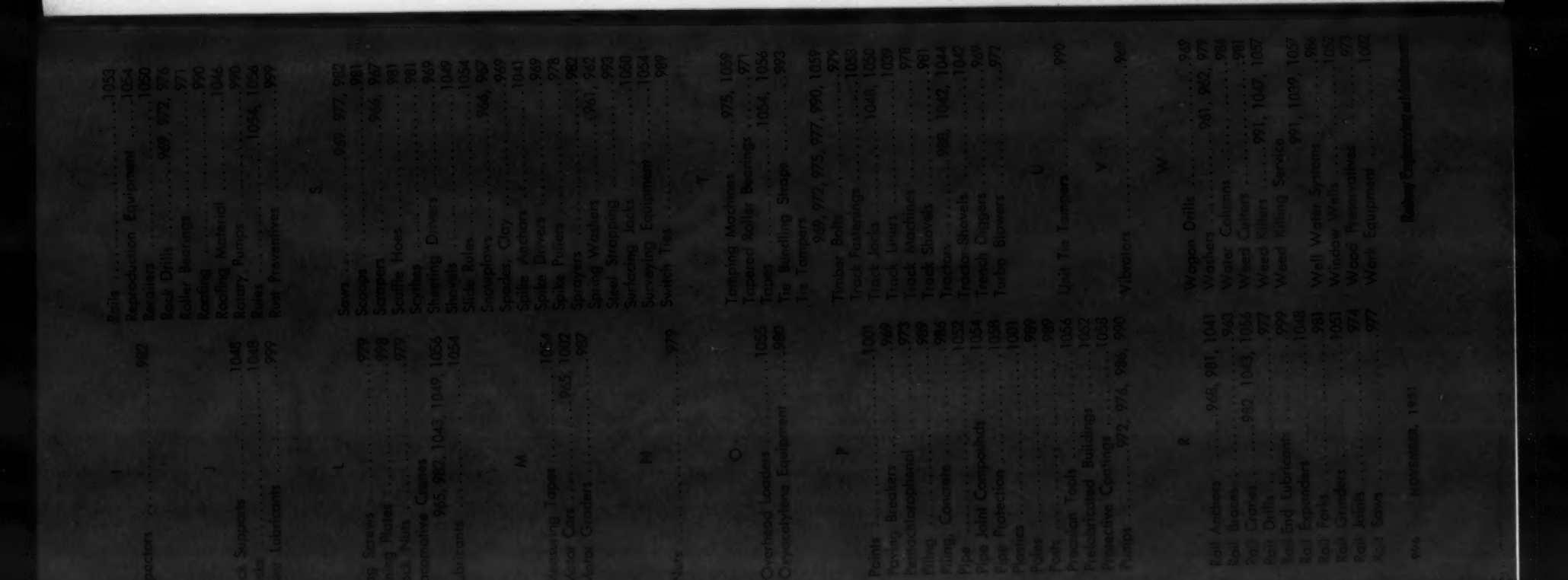

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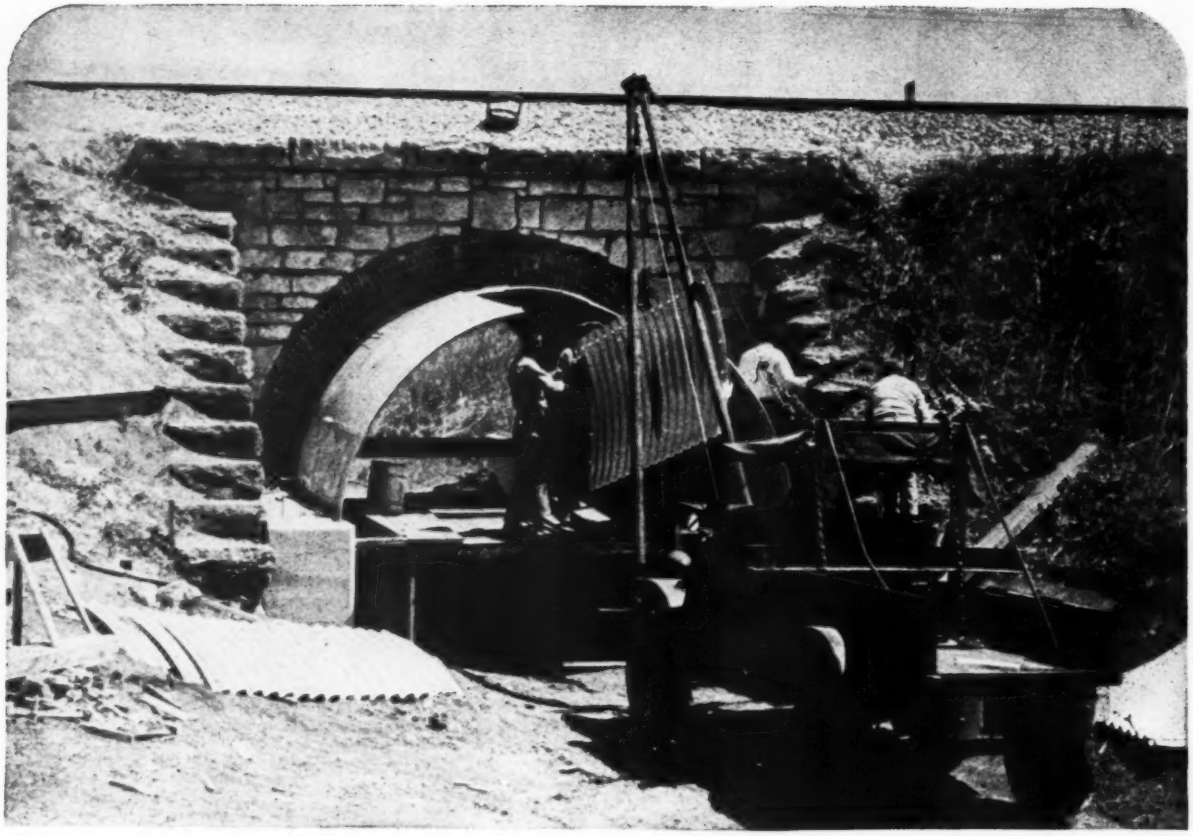

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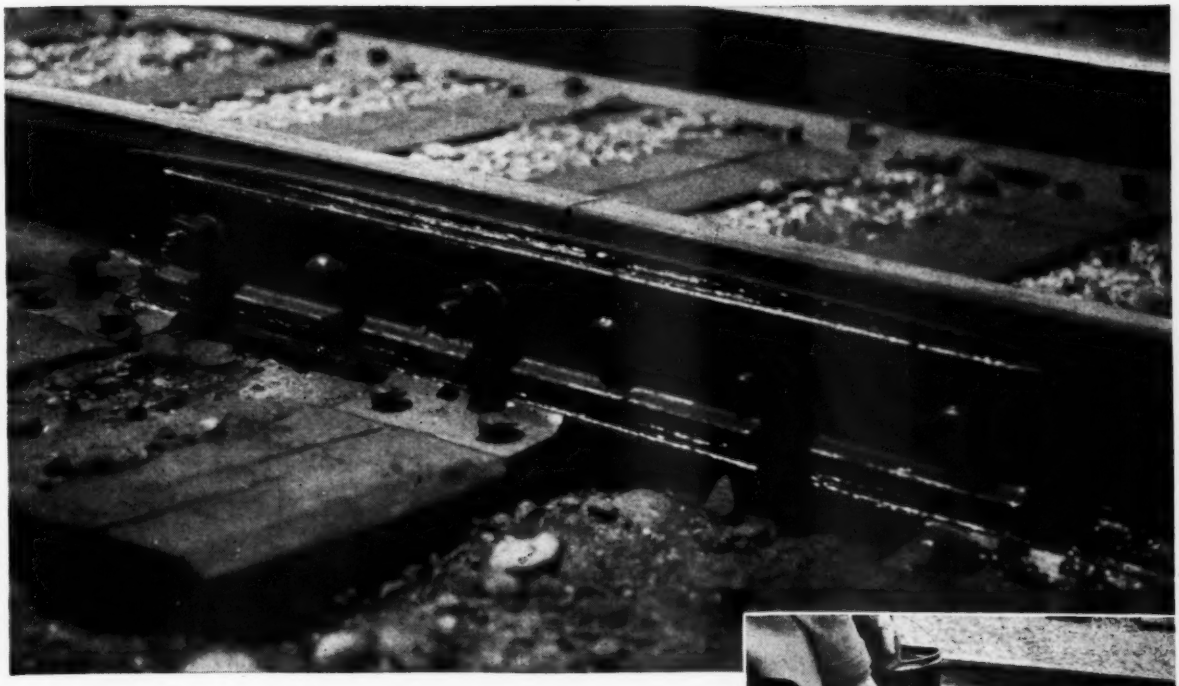

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November 1, 1951

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This suggestion is merely put forward for what you may consider it to be worth. If you should find it acceptable, all that you need to do is to make a list of the men you desire to receive the magazine, giving in each case the title and address, and mail this with the remittance to Robert G. Lewis, assistant to president, Railway Engineering and Maintenance, 30 Church Street, New York 7, N. Y.

Yours sincerely,

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Editor

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VOL. 47, NO. 11 NOVEMBER, 1951

Editorials 1005
Necessity—Supply Men—Machine Operators

Research Shows Coatings Prolong Life of Crossties 1007
T. G. Gill gives the preliminary results of some studies being carried out at the laboratories of the Timber Engineering Company

Machines Speed Recovery of Material from Second Track 1010
Tells how the Southern, using special equipment, salvaged about 180,000 crossties and more than 100,000 cu. yd. of slag ballast

News Briefs in Pictures 1014
Photographs of a new terminal, an employees' clubhouse, a ditching operation, and a special type of ceiling in a new office building

Wide Range of Subjects Discussed at Chicago 1015
A complete account of the B. & B. convention on September 17-19, including committee reports on the following subjects:

Economies in Maintenance and Operation of Heating Plants
Comparative Economies of Materials for Building Exteriors
Protection of Steel Bridges Against Brine Drippings
Effects of the 40-Hr. Week on Bridge and Building Maintenance
Construction of Diesel Fueling Facilities
Fire Protection of Bridges, Trestles and Culverts
Accident Prevention in Maintenance and Use of Work Equipment
Developments in the Use of Laminated Timbers

What's the Answer? 1035
Special Cars Vs. Hoppers
Wood Freighthouse Floors
Cold-Weather Starting of Diesels
Mobile Equipment for Refueling Diesels
House Trailers for B. & B. Employees
T-Rail or Girder Rail on Piers?

Products of Manufacturers 1042

The Month's News 1047

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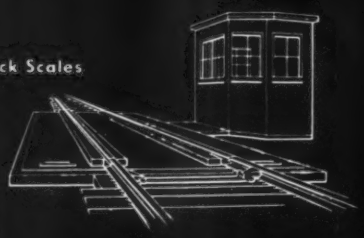
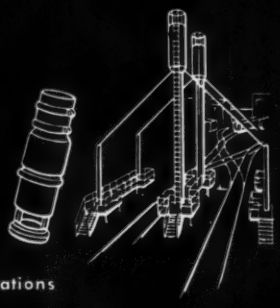
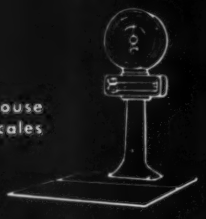


Track Scales

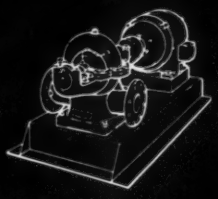
Turbine Pumps



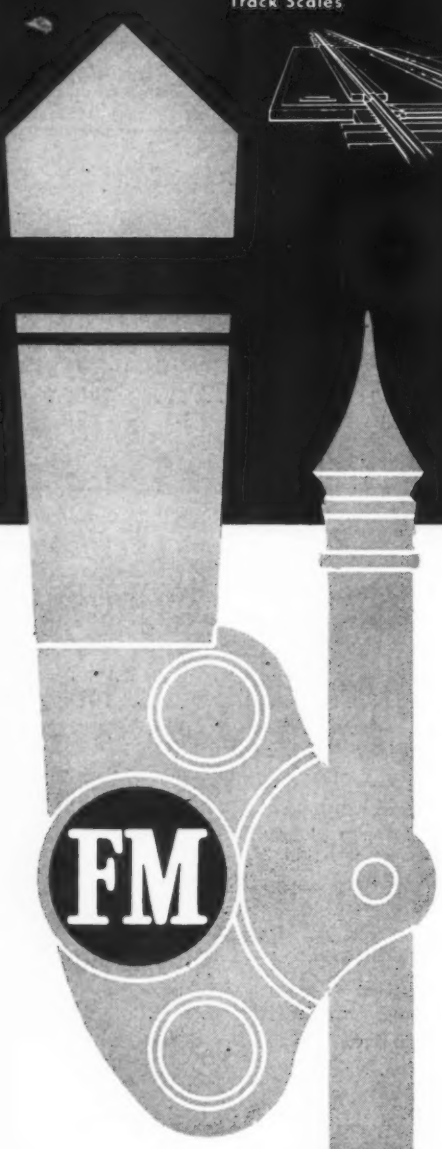
Sanding Stations



Warehouse Scales



Centrifugal Pumps



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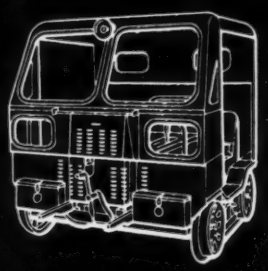


Rail Cars

Generating Sets

Necessity—

Its Role in Maintenance Progress

It is interesting to examine the motivations behind the rapid advances in maintenance of way practices and equipment that have occurred in recent years. Almost immediately it is apparent that most, if not all, of these advances have grown out of the need for counteracting rapidly increasing costs of materials and labor. If pursued a little further this line of thought will result in some interesting conclusions.

Individual railroads differ markedly from each other in what might be called the "factor of safety" in their financial situation; that is to say, some roads must watch their operating expenses more closely than others in order to make a profit or even, in some instances, to remain solvent. Hence, being under greater pressure to save money, it is expected that the "poor" railroads would be quicker to introduce cost-saving innovations, especially those not requiring a large initial expenditure. It is further to be expected that, since such roads must render a service that is on a par with that of their "richer" cousins, these cost-reducing practices must not be such as to sacrifice the standard of maintenance.

Although it would be untrue, as well as unfair, to say that the wealthy lines have in any way been remiss in the introduction or adoption of advanced maintenance practices, it is a fact that many such practices in general use today had their genesis on the less affluent roads. Among these are the large scale use of railway trucks for transporting men and materials, the reorganization of the track forces to make more efficient use of manpower, and the so-called "detour" system of routing trains around large gangs in multiple-track territory.

There are exceptions to every rule, and there are plenty to the one mentioned here. Furthermore, while the less prosperous roads have generally been quick to adopt cost-saving practices where no large initial outlay of money is involved, there is evidence to indicate that in some instances such roads have understandably lagged behind the more prosperous lines in adopting practices that require substantial expenditures. The obvious example here is the use of the heavier rail sections and generally stronger track, although again there are numerous exceptions that could be cited.

The fact is that all railroads are "brothers under the skin" as regards the need for effecting savings, the only difference being the degree to which this need is present. In fact it is the urgent necessity of constantly trying to find ways of doing things more efficiently that is the basic reason for the higher standard of living enjoyed by peoples who exist under the free enterprise system. If, for instance, railroad maintenance men had always had all the money they felt was needed to maintain their properties it is almost certain that progress in this field of endeavor would have been almost nil, and that most operations would still be performed by hand.

For this reason it is understandable that there should be a relationship between the financial health of a railroad and the aggressiveness displayed by its maintenance officers in putting into effect practices designed to reduce costs through greater efficiency. However, even though a particular railroad is relatively strong, it would be more so if its maintenance officers were to conduct themselves as if the wolf were practically at the door, being careful, of course, not to sacrifice maintenance standards.

SUPPLY MEN—

Their Friendship Is Worth Cultivating

THE PROVERB "a friend in need is a friend indeed" is pointed up in these times of material and equipment shortages, and it is the supply man who looms as one of the railroaders best friends. Railway men in all departments look to him for whatever materials, supplies and machines they need. As the sales representative of the supplier, he is also the "go-between" for the buyer, and, as such, is in the best position to furnish information on market conditions, the availability of materials, etc. Because he gets around the way he does, he is also in a position to advise you on what others are doing in similar situations and with similar problems. It is a wise man who nurtures close relationships with these supply men and one might well ask what can be done to cultivate them more successfully.

For one thing, no sales representative enjoys a patronizing attitude on the part of the purchaser. He has a product to sell that he is convinced will fulfill one of your needs; if he did not think so he would not be wasting his time calling on you. Secondly, while he may be disappointed in not picking up an order from you, he is never angry about it; but he will be "burned up" if you cancel an order at the last minute or reduce it to the vanishing point.

Third, unless a product is being tried out on an experimental basis, he prefers a bulk shipment instead of a lot of small orders. At the same time, in these times of shortages, he prefers that you order only what you need, because with his limited quotas he wants to be sure that all of his customers have enough to get by, and he will be quite unhappy when he encounters a customer who is trying to hoard.

He is the authorized representative of his firm and nothing will make him more unhappy than for you to call up his vice-president or go behind his back to the manager with letters or telephone calls on matters that he could handle himself. If differences arise, he would rather straighten them out with you himself in a forthright manner. Your goodwill and continued patronage are important to him and he will not deliberately set out to misrepresent his product. If his product does not come up to the performance that you expected of it, tell him about it and he will do what he can to rectify the matter.

If you cannot see the salesman within a few minutes of his call or arrival, he should be advised to that effect so that, if he desires, he can attend to other business instead of being detained warming one of your chairs. Also, since one of the chief assets of the supply man is his time, nothing is more disappointing to him than to spend a couple of hours with you and then learn that you never had any intention of giving him an order. He would rather be told the truth at the start; he then can allot 15 minutes for friendly conversation and go on his way looking for commissions elsewhere.

Good relationships with supply men are being hampered on some railroads by the practice of assigning certain days of a week for interviews. Many of these men travel long distances at no little expense to come to your town to see you. When confronted with a sign that tells them they must see you the next day, which is a day that is on the "closed" list at another railroad in the same town, it is plain that they are confronted with expensive delays. They would much prefer that all railroads in one town get together on the "closed" days so that they could make all of their calls at minimum expense.

If proper consideration is given these various points there is no reason why your relationship with supply men should not be cordial and mutally profitable.

MACHINE OPERATORS—

Can Their Performance Be Improved?

WHEN groups of men with common interests gather at conventions of their favorite trade associations, private discussions in hotel rooms can often be brutally frank, and for that very reason, if for no other, they are exceedingly valuable.

One of the most interesting discussions heard at the recent conventions held in Chicago of the Roadmasters and Bridge & Building associations concerned the contrasting efficiency of the operating personnel of contract ballast cleaners, for instance, with that of machines run by railroad forces. To those within hearing, it seemed significant that in most cases railway employees suffered by the comparison, even though some of those employees were under the direct supervision of the speakers.

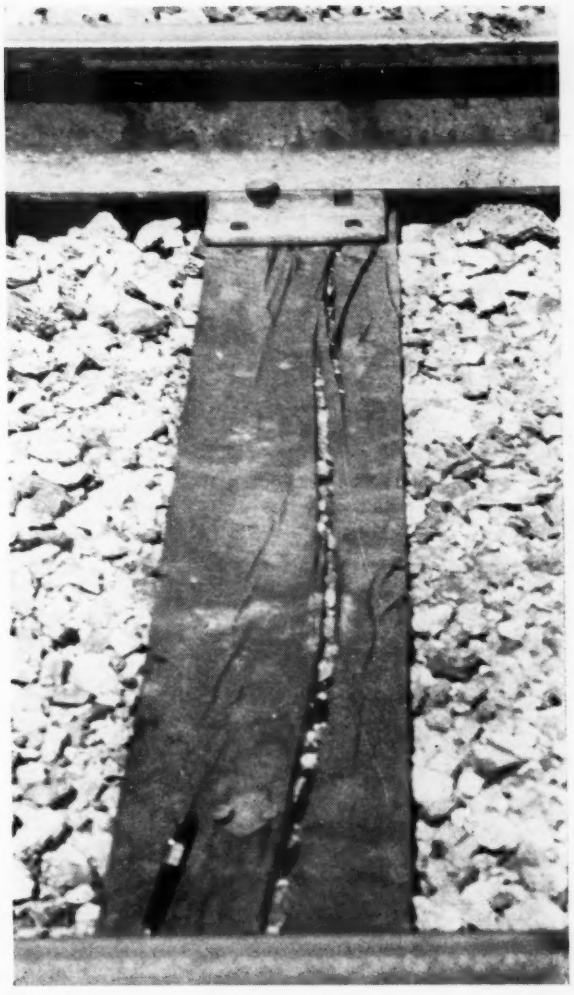
For instance, one man recalled his experiences with a ballast cleaner operated by a contractor, during which he was astounded by the speed with which repairmen and operators diagnosed breakdowns and made effective repairs. He told of men jumping from the machine at the first sign of a work stoppage, running almost directly to the site of the trouble and standing with tools and repair parts in their hands, waiting for the machinery to stop turning so that they could begin the repair work. How did these men get to know their equipment so well? The answer is that they not only helped to build the machine from the rails up but they assisted during off seasons in giving it complete overhauls. Consequently they knew the weakness and the strength of individual parts. They knew the function of all its components and the limits of its endurance. It was partly a product of their own efforts. In short, it was their machine, a pet to be pampered, not an inanimate object to be allowed to fall apart because of careless inattention.

It was the consensus of those entering into this discussion that perhaps a lesson could be learned from this story by some railroads. Perhaps the men who run machinery could overhaul it carefully and thereby learn to use it more effectively. Or in lieu of that ideal, they could be given adequate opportunity to observe its shop overhaul. Why not, if the results are often so effective?

Research Shows Coatings Prolong Life of Crossties

By T. G. GILL
Wood Technologist
Timber Engineering Company
Washington, D.C.

A program of cooperative research to find ways of lengthening the service life of crossties has been under way at the laboratories of the Timber Engineering Company since 1948 under the joint sponsorship of the Association of American Railroads and the National Lumber Manufacturers Association. This article is an exclusive report on the preliminary results of some of the studies being carried out under that program



This crosstie has a seasoning check in which particles of ballast have become lodged. In such cases the rock particles gradually work deeper into the check and may eventually cause the tie to split. Tie coatings are effective in preventing such damage

• By coating the exposed surfaces of crossties, their average life can be extended 5 or 10 years at a cost easily justified by consequent lower annual replacement costs. Such is one of the major conclusions reached so far by our research into the methods of improving the service life of ties.

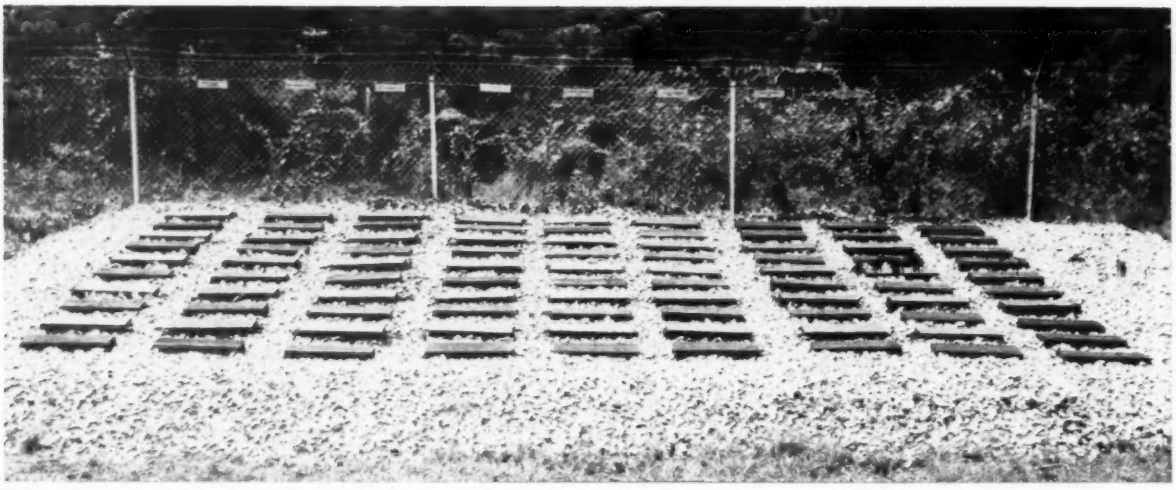
This finding means much to the railways because checking and splitting of crossties in service is, directly or indirectly, a major reason for the large number—30 to 40 millions—of ties replaced each year. This is particularly true of hardwood ties since checks and splits are estimated to be the cause of removal of 50 per cent of such ties that are removed from the tracks each year.

Why Do Ties Split?

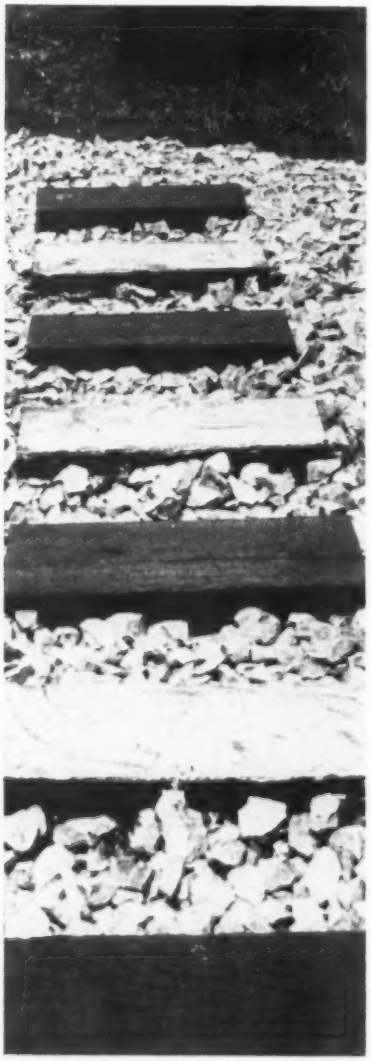
Before undertaking to find out how this waste can be prevented, it is essential that the causes of tie splitting be known and analyzed. It is common knowledge that the top surface of a crosstie is exposed to repeated cycles of wetting and drying while the bottom of the tie is kept at a relative constant temperature and moisture content except for long-time seasonal changes. It has been found that these conditions set up internal stresses caused by the unequal drying of the wood. When these stresses become greater than the strength of the wood, the checks that were developed during the seasoning period may become damaging splits, and/or new checks may occur. Over prolonged dry seasons the top surface continues to lose moisture, thereby setting up additional stresses which, when they become great enough, are relieved by new splits or by existing splits becoming larger.

Also, foreign materials, such as ballast fragments and other debris, settle in the existing splits and act as a wedge which prevents the wood from changing dimensions with the change in climatic conditions. Another important factor is the formation in existing checks and splits of ice, which often exerts sufficient pressure to enlarge the splits until the tie is caused to burst open.

Furthermore, after a tie has been in service several years, much of the creosote on its surface leaches out, permitting the elements to weather the wood. This in itself is probably of minor importance in determining the life of the tie, as it affects only the outer surface fibers of the wood, but, when combined with checking and splitting, it could hasten tie deterioration. Checking and splitting in ties which have drying stresses set up in them are accelerated by the continual pounding and vibration caused by passing trains. If a crosstie could be kept at a uniform moisture content, and thus free from the excessive stresses established by repeated cycles of wetting and drying, checking and splitting, other than the original seasoning checks, should not be a serious factor in its deterioration. Since



Experimental sections of crossties under test at the research laboratory of the Timber Engineering Company, Washington, D. C.



Alternating with control sections in each row are sections coated with a material designed to prevent the checking of ties

a tie is in constant contact with the ground, the average moisture content of the wood in the ties in most areas of the United States is approximately 40 to 45 per cent.

A crosstie in service is unlike a timber that is exposed to the atmosphere on all sides and thus has the highest moisture content in the center and a much lower moisture content on the four exposed sides. The crosstie, being imbedded in ballast, has exposed to the air only the top two or three inches, which portion is usually considerably drier than the remainder of the tie. In many instances the bottom portion of the tie has a higher moisture content than the center area.

With these facts in hand, the initial work on the crosstie research program that has been in progress in the Timber Engineering Company laboratory since 1948 began with staff members making field studies of crosstie deterioration. During these studies it was noticed that ties having a heavy coating of coal-tar residue had not suffered material deterioration by their long exposure to the elements and very few exhibited splits, such as were found in other ties of similar age in the same section of track. This phenomenon was noticed in track in various sections of the country. It was also noticed in several instances that numbers painted on the test ties had become embossed on them. In one instance the number was raised ⅛ in. above the remaining surface of the tie.

These observations indicated that a protective coating applied over the exposed surface of the tie could prevent excessive drying or repeated cycles of wetting and drying, and thereby materially reduce the splitting of ties in service. In addition, such coatings would undoubtedly reduce the volatilization and leaching of creosote from the upper parts of the ties, thereby maintaining the effectiveness of the preservative over a longer period of time. Another possible benefit of coatings applied on new ties prior to the application of tie plates, seems to be that the heavy, viscous material would, to some extent, waterproof the wood in the tie-plate area, and thus have a tendency to reduce the rate of mechanical wear in that area and to minimize spike-killing.

Further evidence of a similar nature is contained in A.R.E.A. bulletin 479, which describes, on page 692, a section of track near Mantena, Ill., on the Illinois Central on which the ballast was covered with hot asphalt in an experiment on waterproofing ballast. One of the conclusions made after five years of service was: "The hot asphalt, when sprayed on the track, filled the checks and adhered to the tops of the ties, forming a bituminous covering, and thus providing protection against weathering. Only 11 ties were removed during the past five years and it is anticipated that future tie renewals will continue to be low." Later information on this ½ mile of test track indicates that after seven years the number of ties requiring replacement has been only about 15 per cent of those replaced in the adjacent comparable test track.

In the fall of 1948, the Administration committee of the joint research program approved a proposal to make tests of coatings that might be applied to ties. To be effective such a coating should pre-

Comparison of Tie Coatings

Compound Number	Months in Test	Temperature of Coating When Applied (Deg. F.)	Rate of Application per 7"x9"x8½' tie (Pounds)	Coverage Index (Per Cent)	Efficiency Index	
					All Checks (Per Cent)	Checks ⅛" and over (Per Cent)
1	16	75	6.0	100	91	95
2	16	300	8.0	19	18	0
3	16	120	5.0	40	0	0
4	16	75	2.5	19	25	66
5	16	250	8.5	53	42	46
6	16	75	7.2	18	24	95
7	16	180	6.8	63	29	94
8a	16	75	4.9	6	6	73
8b	2	75	3.3	100	100	100
9a	15	300	6.0	100	53	55
9b	4	240	3.0	100	88	100
10a	15	300	8.9	73	29	0
10b	12	75	2.8	77	75	28
10c	12	154	15.3	100	38	92
11	5	250	3.7	92	70	100

vent checks, splits, weathering and other deterioration caused by exposure to the elements. It should also be capable of readily filling existing seasoning checks at the time of application, should remain in a plastic condition at low temperature and stay in place at high temperature. In addition, it must be inexpensive, simple to apply, and capable of staying on the tie during its extended life.

Test Section Established

To determine the extent to which various coatings possessed these qualities, an experimental area, 20 ft. by 35 ft. in dimensions, was laid out in the laboratory yard in the summer of 1949 and filled to a depth of six inches with crushed rock to simulate track ballast. One hundred 7-in. by 9-in. by 2-ft. creosoted tie sections were laid in 10 rows of 10 sections each. In a given row alternate sections were coated with selected coating compounds while the remainder were kept at controls.

In accordance with the manufacturer's recommendations, the materials were applied to the top and end surfaces of all tie sections except those in one row which were dipped. The first applications were made in July 1949 and other coatings were subsequently added. To date, 15 different coatings are being tested. Recently, the experimental ballasted area has been enlarged to accommodate the ever-growing interest of manufacturers in having their products tested.

In the study of these test coatings, the efficiency of each compound is based on observations as to ease of application, adherence to the creosoted tie, and the ability of the material to remain plastic throughout the year. In addition, a coverage index and a figure giving the per cent of efficiency in prohibiting the occurrence or enlargement of existing checks, are calculated. The coverage index is an indication of the ability of the compound to fill in existing checks and to produce a smooth, protective covering over the surface of the tie.

Computing Efficiency Ratings

The efficiency rating of each compound in prohibiting checks and splits is computed in two ways. One system is based on the number of all visible checks and the second is based on the end area of all checks or splits ⅛ in. or more in width. The latter figure is of importance because it is the larger checks that develop into the damaging splits that eventually cause the removal of the tie from service.

A good tie coating should have both a high coverage index and a high efficiency index for checks and splits ⅛ in. and larger. As shown in the accompanying table, compounds 1, 8b, 9b, 10c and 11, were outstanding in these respects. However, it appears that some coatings with a low coverage index may be acceptable. For example, coatings 6 and 7 have relatively low coverage indices but over a period of time (16 months) have very good ratings for preventing checks and splits ⅛ in. and over. This qualifies them as adequate for the purpose intended

Other factors that must be taken into consideration are economic in nature. That is, original cost of material, minimum effective rate of application, cost of application, and whether the material is applied at atmospheric or elevated temperatures.

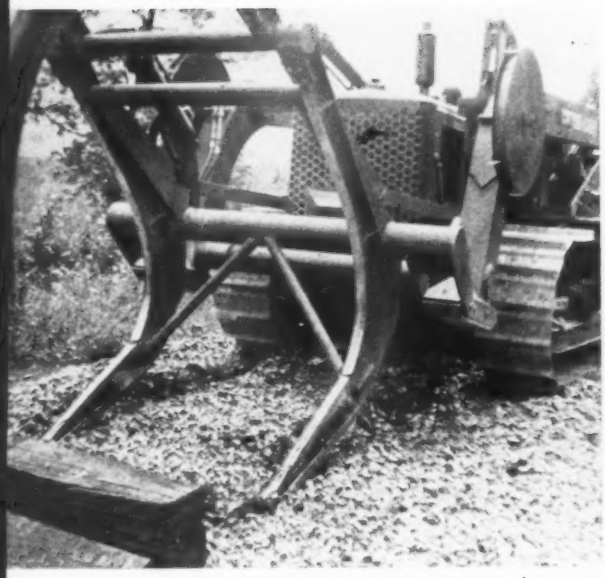
Cost Analyses

It is difficult to make a true comparative analysis of the cost of the coatings because the price varies considerably for the basic compound and according to the volume purchased. For instance, asphalt is probably the cheapest material and it will vary from 11½ cents to 27 cents per gal. depending on whether purchased by tank car or in drum lots. Proprietary bitumen and products having a coal-tar base as used in these tests, varied in quoted prices from 55 cents to $1.29 per gal. in large quantities, and one wax compound was quoted at a price of $1.42 per gal. in large quantities. Several of the compounds are in the experimental stage and no price quotations are yet available.

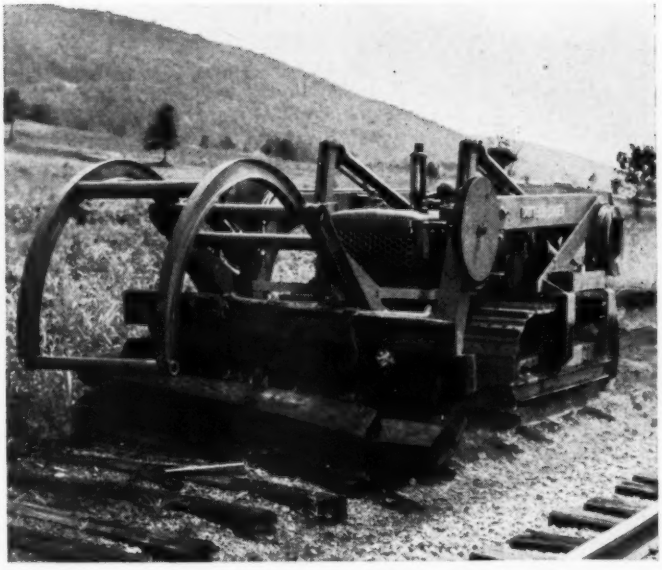
At the present labor rates and cost of materials ties can be coated for 25 to 35 cents per tie. In some cases one man with proper spraying equipment can coat 500 ties per day. At $1.10 per hour for labor and equipment this would be a cost of $0.0176 per tie. It requires 4 to 6 lb., or approximately ½ gal. of coating compound to cover adequately a 7-in. by 9-in. by 8½-ft. tie. At fifty cents per gallon, a price which is not unreasonable if the material is used in quantity, the coating compound costs 25 cents per tie or a total for material and labor of approximatley 27 cents per tie. One manufacturer states that the cost of a 1/16-in. coating is about $.025 per sq. ft. This would total only $.16 for materials to cover a crosstie on the top and ends. Taking the average cost of a tie placed in track at $5.00 and the average service life of a mainline tie as 20 years, the yearly cost per tie is about $0.25.

In general, on the basis of the test now in progress, it appears that tie coatings may be expected to extend by 5 or 10 years, at least, the service life of crossties, particularly hardwood ties, and show a savings in tie costs second only to those obtained by the preservative treatment of ties to prevent decay.

To corroborate these findings, various railways are cooperating in the establishment of field service tests of the coating materials that have given the best performances in the laboratory tests.



To make an efficient tie-loading machine, the Southern mounted on an International TD-14 crawler tractor a strengthened and modified Drott Skid Loader



After the rail and fastenings had been picked up and all unusable crossties removed from the roadbed, the tie-loading machine uprooted the remaining embedded sound ties and crowded them into forks of the loader

Machines Speed Recovery of

This article describes how, in addition to the recovery of 66 mi. of needed secondhand rail and fastenings, the Southern, using mechanical equipment, salvaged about 180,000 crossties and more than 100,000 cu. yd. of slag ballast from three sections of second main track that were retired and taken up when C.T.C. was installed.

• The installation of C.T.C. by the Southern on parts of the main line of its Alabama Great Southern division between Chattanooga, Tenn., and Meridian, Miss., has made it possible for the railroad to take up and retire three sections of second main track, thereby not only saving the cost of maintaining this trackage but also recovering a large amount of usable material. Specifically, these three sections are located between Milepost 48 near Minvale, Ala., and Milepost 70 near Flanders, Ala.; between Milepost 157.3 near Burstall, Ala., and Milepost 178.0 near Vance; and between Milepost 269.7 near York, Ala., and Milepost 292.7 near Meridian, Miss. — a total of 66 track miles.

Because of the steel shortage the railroad found it could make good use of the rail and fastenings released from this trackage. The material was picked up and loaded by conventional equipment, and the rail was sent to one of the Southern's rail-cropping plants, from where the cropped rail, together with the uncropped relayers, was sent out to other locations and relaid.

Road Wanted Ties and Ballast

But the railroad was confronted with something of a problem when it came to the efficient removal and reclamation of the usable ties and ballast remaining after the rail was taken up. About 90 per cent of the approximately 180,000 ties in the track were usable and in addition there were 100,000 or more cubic yards of good slag ballast. Obviously, the salvage of this material was highly desirable but the cost of recovery had to be comparable to the value of the materials recovered.

The Southern placed the problem before a committee formed from its engineering department. The committee looked first in the catalogs of equipment manufacturers in the hope that it might find a "ready-made" answer to the problem. Failing this, the committee next considered the possibility of adapting existing equipment to the special tasks involved. Various studies indicated that the most economical method of recovering the crossties would be by banding them into bundles of 20 to 25 ties each while being held in some sort of a loading mechanism.

It was decided that a TD-14 International Harvester tractor equipped with a modified Drott Skid Loader could be made into a tie-loading machine. The tractor is a crawler type of about 60 hp. and the skid loader has upper and lower forks with an hydraulically controlled lift mechanism. Since the skid loader as manufactured was designed to pick up corded pulpwood or similar timber, it was evident that it would be necessary to strengthen the skids and shoe them with wear-resistant material

When a load of 20 to 30 ties had been gathered, the tie loader was stopped, steel strapping was unrolled from reels and cut to the length required to bind ties into a bundle. The ends of the strapping were brought around to front of the machine where four men, working in teams of two, tightened the bands with stretching tools and fastened ends together with seals.

Material from Second Track

before they could be used for this special application. The manufacturer of the skid loader cooperated in the altering of his product and applied removable manganese steel shoes to the skids and strengthened the structural steel girder arms with welded tubular stiffeners. The plow shoes were made detachable because they were expected to wear rapidly. This supposition later proved to be correct; after two weeks of operation, both of two sets of plow shoes had worn through on their bottom surfaces.

How Tie Loader Works

Before the tie-loading machine was put into operation, the few crossties that were not suitable for re-use were removed from the roadbed. The tie-loading machine then advanced along the roadbed with the plow shoes held below the bottoms of the ties, thus crowding them between the upper and lower forks of the loader.

Because of the up-and-down motion of the loader and to prevent the upper fork from becoming damaged by being rammed against embedded ties, the bottom of this fork was carried at a higher elevation than needed to provide an opening for

After each bundle of ties had been gathered and banded, it was deposited on one side of the roadbed near the ballast toe line. The tie bundles laid about 35 ft. apart

the ties to enter. Neater and more uniform bundles than those actually obtained would have been possible if the upper fork could have been allowed to drag along the bedded ties, because the bundles would have formed quicker with less chance of the ties to roll. The first 8 or 10 ties entering the loader determined the character of the bundle in so far as regularity and evenness were concerned. Warped ties definitely caused trouble because they did not roll evenly within the forks, and also created a void in the bundles by wedging other ties out of position.

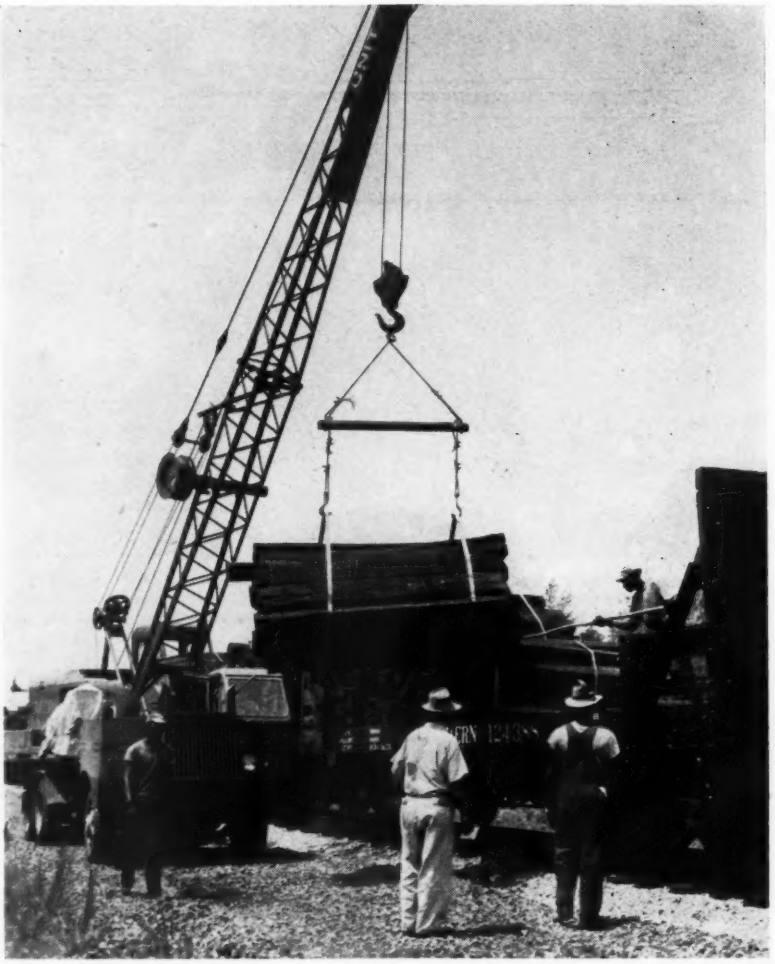
Ties were banded together in bundles of 20 to 30, depending upon the sizes of the ties — those recovered from curved track usually making up the bundles having the fewer ties. Each bundle was integrated by two steel bands, 2 in. wide by 0.05 in. thick, each band being applied about 18 in. from the tie ends while the ties were held in the skid loader. Reels for holding the steel banding material were mounted at the forward ends of the loader arms where they were readily accessible for the banding operation. In addition, spare rolls were carried on holders near the rear of the loader arms where they were immediately available when needed. This was an important feature as it provided enough steel banding material to keep the tie-loading machine in continuous operation for one-half mile, after which other rolls, previously distributed, were picked up as the machine passed. A supply of seals, as well as tools and lunch boxes, were carried in tool boxes mounted on each side of the machine.

Crew of Six Men

Five men, in addition to the tractor operator, were assigned to the tie loading and banding operations. Four men, equipped with strap-stretchers, cutters and seals, were employed in teams of two on each side of a bundle in fastening the bands, while the fifth man worked at odd jobs such as marking and counting the ties in each bundle, reloading and greasing the banding reels, and helping to straighten ties before the bands were tightened.

One man of each of the two banding teams unrolled the steel strap from the reel after the skid had been loaded, while the other carried the end around the ties to be bundled. The first man then cut the strap, allowing a lap of between 10 and 12 in. for grasping by the stretcher. The two ends were then carried around to the front and, after being lapped through a seal, were pulled up as tightly as possible by means of the stretchers.

The fitting of the stretchers to the strapping was the most difficult phase of the bundling operation. Sometimes, due to haste, or to the tightness of the bands against the flat surfaces of the ties, and also due to the proximity of the upper fork, the men would fail to get the crimping edges of the sealing tool completely under the seal. This resulted in the band ends bucking away from the seal instead of going up into it. In such instances, a new seal with one side bent outward was supplied by the tractor operator and applied. During the banding operation, the tractor operator would shake the skid load to settle the ties more closely together and to shake out the loose ties. When the banding had been completed, the bundle was deposited on one side of the roadbed.



A Unit truck crane picked up the tie bundles with slings and loaded them onto cars

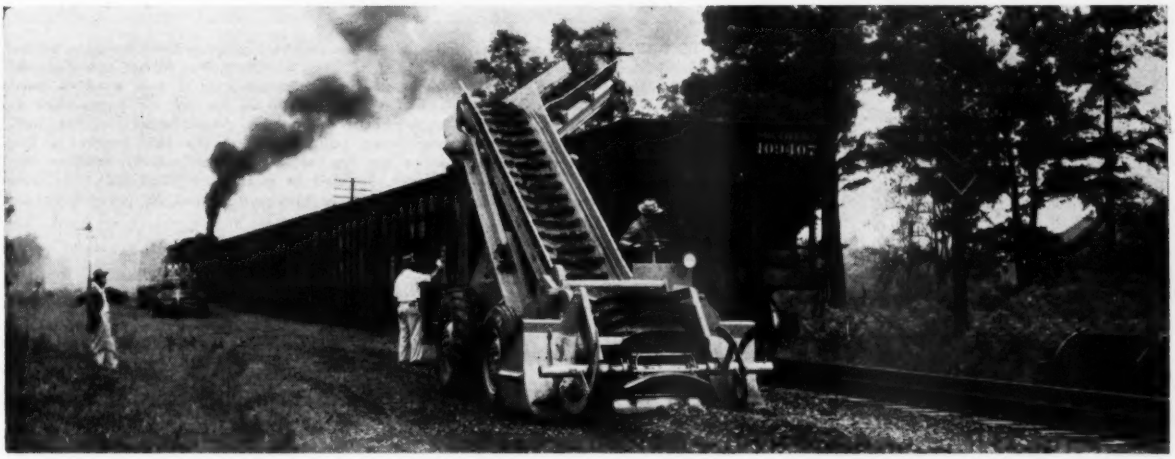
After the tie loading and banding crew became proficient in these operations it was able to maintain a 2.5-min. banding-and-loading cycle. Despite the delays caused by bad sealing, badly loaded bundles that had to be re-worked in the machine, curves, travel time, and repairs to the machine, the crew averaged 0.9 mi. of ties removed and banded in an 8-hr. day. This means that the ties in each mile of track, numbering approximately 2900, were bundled and banded with an expenditure of only 54 man-hours.

Picking Up Tie Bundles

The tie bundles, which lay approximately 35 ft. apart, were then picked up by a Unit Model 1014 truck crane, using a specially designed bridle sling with hooks spaced to fit the bands, and loaded onto flat cars of a work train occupying the remaining main track.

Recovering the ballast presented a more complex problem. First of

After the crossties had been loaded, a Caterpillar Model 12 motor grader was used to cast the slag ballast into windrows



An Athey Force-Feed Loader was then employed to pick up the slag ballast and cast it into the hopper cars of a work train

all, it was decided to remove the ballast down to the roadbed, leaving an adequate slope for cross drainage, and then to use the bare roadbed with some ballast bedded in it for an access highway for motorized maintenance equipment. This meant the removal of a mass of slag ballast about 10 ft. wide and 12 to 18 in. deep. A bulldozer or a blading machine of some kind was needed to throw the ballast into a windrow convenient for picking it up, and a self-propelled loading conveyor was also needed to pick up and load the ballast in hopper cars in a work train alongside.

A conventional bulldozer was tried out for windrowing the ballast, but was found to be awkward and ineffective. A motor grader proved to be more effective, and a Caterpiller Model 12 was provided for this purpose. The ballast had to be windrowed more than once because the volume was too great to permit all of it to be picked up with any conventional machine in one trip. The motor grader was also useful for dressing the roadbed after the ballast had been removed.

There are a few conventional models of loading machines available that have adequate capacity and can propel themselves. But none was able to do all the things required for the job of recovering and loading the ballast in hopper cars. What was wanted was a machine that could move forward, pick up the ballast at the rate of 400 to 500 cu. yd. per hour, elevate the material to the height of a car, and load it by means of a conveyor able to swing through an arc of 90 deg. to the axis of the loader—and all of this at the same time.

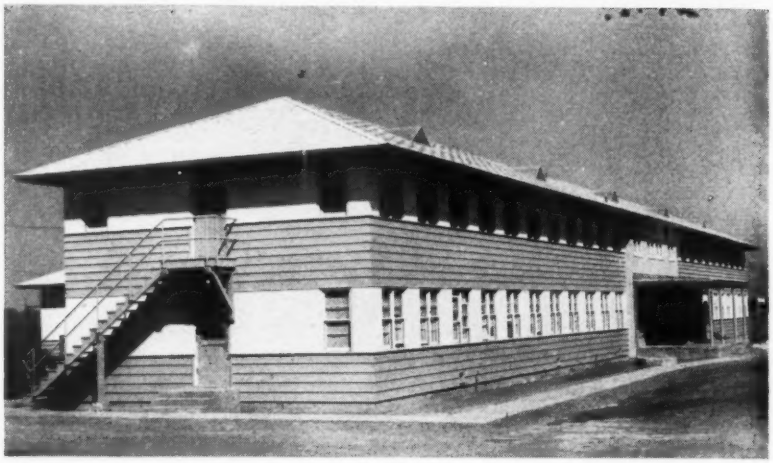
Machine Selected

The machine that came the closest to satisfying these conditions was the Athey Model 125 Force-Feed Loader. While it is a powerful machine with adequate speed and capacity, it cannot load a high hopper car from railroad level and the side conveyor cannot swing 90 deg., so the railroad forces made the necessary changes to impart these characteristics. The conveyor was raised, extended and strengthened, and hydraulic power for the swing conveyor was installed, with the result that material could be placed in any type of car at the required speed while train and loader were both in motion. Cars were loaded in a matter of minutes and a train load was easily recovered in a work-train day.

For the most part, the crossties and ballast recovered from these retirements of the second main tracks were shipped to Birmingham, Ala., and used in the building of the Ernest Norris yard now under construction at that point.

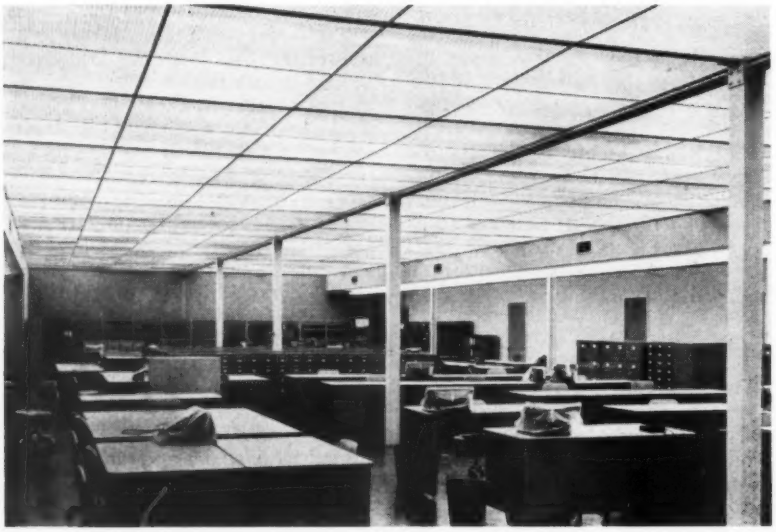
This article is based on information prepared by J. N. Todd, superintendent of scales and work equipment of the Southern, and George S. Baron, assistant supervisor.

News Briefs in Pictures



FORCED TO MOVE part of its lines in northern Oregon to higher ground because of the construction of the McNary dam on the Columbia river, the Union Pacific has consolidated all its switching operations and repair facilities in the area in a new modern yard and terminal (left) at Hinkle, Ore., which was placed in service on September 2. In the center foreground is the enginehouse with the powerhouse to the left. The long building beyond that covers two repair tracks. Up the tracks is the yard office. One of the new buildings on the site that particularly catches the eye is the employees' clubhouse (above). Erected at a cost of $233,000, this trim two-story structure houses a lounge, a kitchen, a lunchroom, and 63 private rooms

IN DIGGING 3½ miles of new drainage ditch along its main line near Vermilion, Ohio, the Nickel Plate used a Lorain TL crane (above) with a ¾-yd. dragline bucket. The new ditch, running parallel with the old one, is 8 ft. wide at the top and 5 ft. to 8 ft. deep. The excavated material was used to fill in the old ditch and also to widen the roadbed



THIS CEILING (left) in the new office building of the Toledo, Peoria & Western at Peoria, Ill., is constructed of expanded metal, i.e., sheet steel that has been slit and stretched to form attractive diamond-shaped patterns. This type of ceiling hides unsightly ductwork and beams, and at the same time provides diffusion of light from fluorescent fixtures. The expanded-metal panels, manufactured by the Wheeling Corrugating Company, Wheeling, W. Va., are supported by a metal framework painted to match the office's interior decoration scheme

Convention Review —

Bridge and Building Association

Wide Range of Subjects Discussed at Chicago

Eight technical committee reports presented at fifty-sixth annual meeting of association, which was held concurrently with Roadmasters' convention. Crites elected an honorary member

• Such problems of long standing as the operation and maintenance of heating plants, and the protection of steel bridges against brine drippings—along with problems of more recent development, such as the effect of the 40-hr. week, and the construction of Diesel fueling facilities—were recently given a thorough airing by supervisory officers of the bridge and building departments of the country's railroads. The medium through which these problems were considered was the fifty-sixth annual convention of the American Railway Bridge and Building Association, which was held at the Stevens hotel, Chicago, September 17-19. Continuing the practice started in 1946 this meeting was held concurrently, but separately, with the annual convention of the Roadmasters' and Maintenance of Way Association.

A complete account of the Roadmasters' meeting was published in the October issue, including verbatim reproductions of the six technical committee reports that were presented at that meeting. The story in the October issue also reported the various activities in which the associations participated jointly, including the combined opening session on Monday, September 17, and another joint session on the afternoon of the following day. The program of the latter session consisted of features of common interest to the two groups, including an address by a railroad president, a motion picture, and a round-table discussion of the problems of flood rehabilitation encountered during and following the record floods that occurred in the Kansas City area in July. Another feature of the concurrent conventions, as summarized in the October issue, was the annual banquet which was tendered to the members and families of the two railroad associations by the Track Supply Association and the Bridge and Building Supply Association. In accordance with an agreement of several years' standing no exhibit of manufacturers' products was sponsored this year by the two supply associations.

The combined attendance at the two conventions, as reported in the October issue, totaled 1,051 railway men and guests. This included 681 railway men and 370 supply men (associate members) and guests. In 1950, when an exhibit of manufacturers' products was held simultaneously with two conventions, a total of 1,159 persons registered at the two conventions.

The separate sessions of the Bridge and Building Association were directed by W. A. Huckstep, general supervisor of buildings, Missouri Pacific, St. Louis, Mo., and president of the association. He was assisted by Guy E. Martin, superintendent water service, Illinois Central, Chicago, and first vice-president of the association.

President Huckstep at opening session

President Huckstep's Remarks

Addressing the first separate session of the Bridge and Building Association, President Huckstep devoted his remarks primarily to the subject of courtesy, both from the standpoint of its application in creating public good will and its effect in promoting good relations between supervisors and the employees under them. While much has been heard about this subject Mr. Huckstep's reason for discussing it at the convention was that "any good thing will bear repetition."

"Regardless of any other qualifications he may lack as a salesman," said Mr. Huckstep, "if he is courteous in all of his contacts, an employee can influence business to his railroad and at times may even do so without actually being aware of it." By the same token, "by lack of

Convention Pictures

On the following pages are presented photographs snapped in the Stevens hotel during the Bridge & Building and Roadmasters' conventions. Additional pictures taken during the meetings appeared in the October issue.

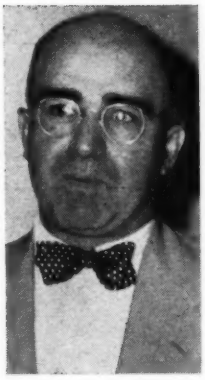
Elected at the convention, the new officers of the Bridge & Building Association are . . .

Guy E. Martin
President

F. R. Spofford
1st Vice-President

Lee Mayfield
2nd Vice-President

H. M. Harlow
3rd Vice-President



J. A. Jorlett
4th Vice-President

courtesy he may possibly some time bring about the opposite results." Mr. Huckstep then went on to cite two instances in which acts of discourtesy created unfavorable impressions.

"How many of us," inquired Mr. Huckstep, "perhaps irritated for some reason, or possibly a bit too encumbered with work, have answered a telephone, or talked to some person at the end of the line differently than we would have spoken if the person had been sitting across the desk? In the letter we write do we always express our thoughts in the same words we would if we were carrying on a face-to-face conversation with the person to whom we are writing? Do we instruct people to do something when the same results can be obtained by requesting them to do it?"

In the relationship between supervisory officers, foremen and men, Mr. Huckstep described courtesy, as being the application of sympathetic understanding. "Courtesy begets respect," he said, "and certainly every supervisory officer should want the respect of the men under his jurisdiction." Noting that all people are not alike, either in appearance, disposition, habits, or other characteristics, Mr. Huckstep explained that "if a supervisor should have men under his jurisdiction from whom satisfactory service or full cooperation is not being secured he has just as many different problems to solve as he has men with these shortcomings. By employment of tact," he continued, "he can learn just what is necessary to transform such a man into a satisfactory, valuable and satisfied employee. Perhaps a man may be troubled by something that is affecting his work. In such a case sympathetic understanding and patience on the part of the supervisor may help to find a solution. Certainly criticism, particularly in the presence of a man's fellow employees, will not do the job and, inwardly at least, he will resent it. If an employee must be criticized or censored, and no doubt there are instances when this becomes necessary, it should be done privately."

Observe Sixtieth Anniversary

A feature of the Bridge and Building sessions was a special program commemorating the association's sixtieth anniversary. On this occasion nine past-presidents of the association were present, including E. H. Barnhart, division engineer, Baltimore & Ohio, who arranged and directed the special program; A. E. Bechtelheimer, engineer of bridges (retired), Chicago & North Western; G. S. Crites, division engineer (retired), Baltimore & Ohio; R. E. Dove, associate editor, *Railway Engineering and Maintenance;* L. D. Hadwen, engineer masonry construction (retired), Chicago, Milwaukee, St. Paul & Pacific; J. S. Hancock, bridge engineer, Detroit, Toledo & Ironton; N. D. Howard, secretary, American Railway Engineering Association; W. F. Martens, general foreman bridges and buildings, Atchison, Topeka & Santa Fe; and T. H. Strate, division engineer (retired), Chicago, Milwaukee, St. Paul & Pacific. A novel feature of this program was the playing of a wire recording of remarks by the oldest living past-president of the association—J. P. Canty, retired assistant to the engineer maintenance of way of the Boston & Maine. Mr. Canty is 86 years old and served as president of the association in 1908-09. Mr. Crites was elected an honorary member of the association at the meeting.

The separate sessions of the Bridge and Building Association were given over largely to the presentation and consideration of eight technical committee reports on the following subjects: Construction and Maintenance of Diesel Fueling Facilities; Develop-

Subjects for 1952

Immediately following the close of the convention the Executive Committee of the Bridge & Building Association selected eight subjects on which committee reports are to be prepared for presentation at the 1952 convention. These are as follows:

(1) Restoring and Prolonging Life of Masonry Structures.
(2) Fire Prevention through Regular Inspections.
(3) Maintenance of Track Scales.
(4) Safety Problems of the Supervisor.
(5) Developments in Power Tools and Machines.
(6) Present Trends in Modernization of Passenger Stations.
(7) Methods of Repairs to Steel Bridges and Structures.
(8) Inspection and Maintenance of Water Tanks.

ments in the Use of Laminated Timbers; Economies in Maintenance and Operation of Heating Plants; Fire Protection of Bridges, Trestles and Culverts; Accident Prevention in Maintenance and Use of Work Equipment; Protection of Steel Bridges Against Brine Drippings; Comparative Economies of Material for Building Exteriors; and Effects of the 40-Hr. Week on Bridge and Building Maintenance.

After the close of the business session on Wednesday noon, September 19, about 55 of those present, including a number of wives of members, participated in a bus trip to inspect the testing facilities at Chicago of the Underwriters' Laboratories, Inc.

In the election of officers, Mr. Martin was advanced to president; F. R. Spofford, assistant division engineer, Boston & Maine, Dover, N.H., was advanced from second vice-president to first vice-president; Lee Mayfield, resident engineer, Missouri Pacific Lines, Houston, Tex., was moved up from third vice-president to second vice-president; H. M. Harlow, assistant-ant general supervisor bridges and buildings, Chesapeake & Ohio, Richmond, Va., was promoted from fourth vice-president to third vice-president; J. A. Jorlett, assistant engineer, Pennsylvania, New York, was advanced from director to fourth vice-president; and L. C. Winkelhaus, architectural engineer, Chicago & North Western, was elected treasurer. Directors elected were L. R. Morgan, fire prevention engineer, New York Central, Detroit, Mich. (re-elected); B. M. Stephens, assistant chief engineer, Southern Pacific Lines in Texas & Louisiana, Houston; and W. H. Huffman, division engineer, Chicago & North Western, Chicago.

The eight committee reports presented during the meeting are printed in full on the following pages, along with abstracts of the discussions.

Comparative Economies of Materials for Building Exteriors

Report of Committee*

• The study of comparative economies of materials for building exteriors is somewhat on the abstract side. The reason for this is the necessary introduction of several modifying and important variables, namely:

(a) The relationship between specified localities and the overall availability of building materials;

(b) Quantity and quality of skilled labor available locally for the application of given types of building materials;

(c) The utility of, or service to which, the building to be constructed or modernized is to be put; and

(d) Certain intangibles applying to appearances and to the purposes to be achieved, as modified by standards of construction peculiar to individual localities and railroad managements.

These variables must necessarily exert an important influence upon the development of any criteria applying to the comparative economies of materials for building exteriors. This influence, in point of fact, has been found to be such as to make impracticable the development of specific statistical data suitable for unrestricted general use.

Nevertheless, there are certain generalities and fundamentals applying to the matter of comparative economies of materials for building exteriors, which can well be stated in the form of a report. It will be the purpose, therefore, of this report to outline certain precepts which the committee believes can be generally accepted and applied with reasonably satisfactory results, provided they are properly modified where conditions so require.

As a practical matter, almost every type and kind of building or construction material presently known and available to the trade can be used in one form or another for exteriors of buildings. These materials divide into four general classifications, namely, (1) masonry and masonry products, (2) wood and wood products, (3) metals of various kinds, and (4) compounded and specially processed materials.

B. M. Stephens
Chairman

The masonry group includes such items as common and face brick, concrete blocks, various kinds of building stone (including granite and marble), common and face tile, architectural terra cotta, concrete architectural stone, architectural concrete, opaque structural glass, glass blocks, structural glass-faced masonry units, and corrugated glass sheets.

Wood siding of various patterns and species makes up the bulk of the wood group; although, in certain parts of the country extensive use is being made of cedar and redwood shingles and shakes for siding purposes.

In the metal group, there are galvanized corrugated steel sheets, corrugated aluminum sheets, stainless steel flat sheets, specially molded aluminum siding, specially fabricated galvanized flat steel panels, pre-fabricated metal structures, and porcelain enameled steel sheets, to name the most generally used items.

The specially processed group of materials includes, among others, items such as asbestos-cement siding and shingles, corrugated asbestos-cement sheets, asphalt-impregnated fiberboard covered with finely ground mineral chips, and various forms of stucco applied over wood or metal lath or over masonry surfaces.

From the standpoint of service life and general overall economy of maintenance, as well as from the standpoint of general overall appearance, masonry construction stands practically in a class by itself. Unfortunately, however, the initial cost of masonry construction is generally at a higher level than that of any of the other types of construction and, in some isolated instances, maintenance costs of masonry construction may also be found to be at a relatively high level.

Within the masonry class itself, there are many different price levels, each level being dependent upon the type of construction and kinds of materials used. Sometimes, therefore, it is necessary to sacrifice service life, and possibly appearance and maintenance considerations to some extent because of the initial cost of construction being beyond the limits of authorizations at hand.

In such cases, dependent upon considerations as to use and occupancy and, possibly, resistivity to fire damage and mechanical wear and tear, metal or asbestos-cement covered timber-framed buildings, buildings built entirely of wood or metal, or asbestos-cement clad steel frame buildings, are usually indicated.

In general, railroad building construction and modernization is limited to such items as passenger and freight stations,

*Chairman of this committee was B. M. Stephens, assistant chief engineer, Texas & New Orleans, Houston, Tex.; vice-chairmen were J. H. Babbitt, assistant division engineer, Baltimore & Ohio, Indianapolis, Ind., and L. E. Peyser, architect, Southern Pacific, San Francisco, Cal.

G. W. Neal, superintendent, C. V.; Lee Mayfield, resident engineer, M. P.; P. S. Settle, assistant division engineer, P. R. R.

J. G. Smith, assistant cost engineer, E. B. Jones, supervisor bridges and buildings, S. H. Poore, assistant engineer, all C. & O.

shop buildings, miscellaneous small roadway buildings, and general-duty warehouses. Small office, depot and other kinds of buildings must sometimes be provided, but it is not often that construction of major office and passenger and freight-station buildings is necessary. Work involving major buildings is generally limited to the modernization of such facilities.

The selection of materials for new building construction or major remodeling of existing buildings, in a great many instances, is governed to a large extent by building-code requirements. This is particularly true in the larger cities and towns where the more important railroad buildings generally are located in restrictive fire zones. Compliance with code requirements frequently narrows the materials field to the point where there is little choice left between the various items in the above-mentioned general classifications of building materials.

In addition to code requirements, it is more often the rule than otherwise that certain railroad standards have the effect of further restricting the selection of materials to certain types and kinds. Under such situations, in order to develop a comparison of economies of materials, the designer must balance, one against the other, several governing factors as follows:

(a) Utility of, and purpose to be served by, the construction and the effects upon the construction of building-code requirements and railroad standards as to types of materials which can be used.

(b) Availability of materials for reasonable delivery at prices commensurate with final desired results.

(c) Availability of skilled and competent labor as well as costs applying to use of such labor.

(d) Life expectancy of various types of materials available for use, with particular attention being paid to ability to withstand damage, due either to geographic location or use and occupancy.

(e) Determination within reasonable limits as to extent of maintenance required over a period of years from the standpoint of preservation of materials as well as from an appearance standpoint.

There appears to be no set rules by which determination can be made as to the proper weight which should be allocated to any one of the factors mentioned. As a general proposition, any given project will most likely be sufficiently dissimilar from any other project so that the arrival at proper weighted average of the factors is largely a matter of experience.

In recent years, the railroads have found it necessary to remodel and reconstruct many railroad buildings, not only for the purpose of bringing them up to modern, progressive standards but also because a large number of the buildings, having been built near the turn of the century, were wearing out and were inadequate for present-day requirements. Also, the rapid changeover from steam power to diesel power by many of the nation's railroads in the past few years has made it necessary that new buildings to house, service, and repair diesel locomotives be provided in many instances.

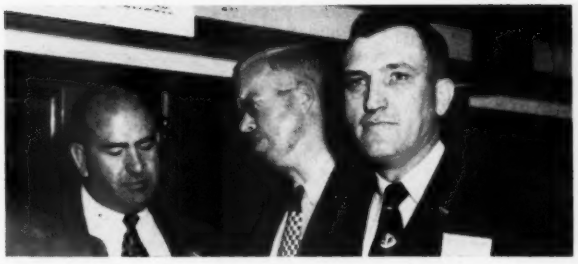
Guide for Use of Materials

There are about as many opinions applying to methods of procedure and utilization of materials, in so far as railroad building construction and modernization is concerned, as there are railroad architects. For this reason, it is difficult to develop recommendations suitable to all in every respect. As a statement of basic principle, however, the following is suggested as being a reasonably practicable guide in the matter of utilization of materials for building exteriors. The listings given, bearing in mind that varying modifying factors may effect the order one way or another, *are roughly in order of increasing cost.*

I. For large terminals and other relatively important locations and structures.
   A. Station and office buildings.
      (1) Face brick or unglazed facing tile, with masonry backing of common brick, concrete blocks or hollow tile, from foundation to window-sill level, balance of construction being of concrete block finish by application of stucco.
      (2) Face brick or unglazed facing tile, backed up with common brick, concrete blocks, or hollow tile, used throughout the construction.
      (3) Pre-cast concrete architectural stone facing, with low-cost masonry backing, or cast-in-place finished architectural concrete walls used throughout or in combination with other types of finished masonry.
      (4) Natural cut stone with low-cost masonry backing used in entirety or in combination with other types of finished masonry.
      (5) Architectural terra cotta or structural glass-faced masonry units with low-cost masonry backing used throughout or in combination with other types of finished masonry.
      (6) Granite veneer, cut granite, or marble facing on concrete or other suitable masonry backing used in entirety or in combination with other types of finished masonry.
   B. Shop buildings, storehouses, freight stations, etc.
      (1) Concrete blocks, finished with brushed-on Portland cement wash or Portland cement paint, from foundation to window-sill level, balance of construction being of corrugated steel siding, corrugated aluminum siding, or corrugated asbestos-cement siding on steel or reinforced concrete framework.
      (2) Pre-cast architectural concrete panels erected by tilt-up or other methods of erection, used throughout.
      (3) Cast-in-place concrete walls from foundation to window-sill level, in lieu of concrete blocks, with various wall combinations as noted to be used with concrete blocks.
      (4) Common brickwork from foundation to window-sill level in lieu of concrete blocks or cast-in-place concrete, with various wall combinations as noted to be used with concrete blocks or cast-in-place concrete.
      (5) Concrete blocks finished with brushed-on Portand cement wash or Portland-cement paint, used throughout the construction.
      (6) Common brickwork used throughout the construction.

II. For suburban areas, smaller terminals, and less important locations and structures.
   A. Station and office buildings.
      (1) Timber framing with wood novelty siding of not less than 2-in. thickness up to window-sill level, or other desired height, balance of construction being of rigid asbestos-cement shingles or aluminum novelty siding on solid sheathing of wood or other suitable sheathing material.
      (2) Timber framing, solid-sheathed with wood or other suit-

P. H. Swales, assistant engineer, C. E. Garcelon, superintendent bridges and buildings, E. E. Gordon, general roadmaster, all B. & A.



F. R. Spofford, assistant division engineer, B. & M.; L. R. Morgan, fire protection engineer, N. Y. C.; R. G. Simmons, general roadmaster, C. M. St. P. & P.

able sheathing material, finished with lathing and stucco.

(3) Concrete blocks, finished with brushed-on Portland-cement wash or Portland-cement paint, or cast-in-place concrete wall from foundation to window-sill level, balance of construction being of wood novelty siding, rigid asbestos-cement shingles, or aluminum novelty siding on solid sheathing of wood or other suitable sheathing material.

(4) Common brickwork from foundation to window-sill level, in lieu of concrete blocks or cast-in-place concrete, with various wall combinations as noted to be used with concrete blocks or cast-in-place concrete.

(5) Face brick or unglazed facing tile, backed up with common brick, concrete blocks, or hollow tile, from foundation to window-sill level, balance of construction being of concrete block finished by stuccoing in any desired color.

(6) Concrete blocks finished with brushed on Portland-cement wash or Portland-cement paint used throughout the construction.

B. Shop buildings, storehouses, freight stations, etc.

(1) Pre-fabricated metal buildings on concrete slab, non-insulated or insulated according to use requirements.

(2) Steel framing covered with corrugated steel, zinc, or aluminum siding.

(3) Steel framing covered with corrugated asbestos-cement siding.

(4) Concrete blocks, finished with brushed-on Portland-cement wash or Portland-cement paint, or cast-in-place concrete wall from foundation to window-sill level, balance of construction being of corrugated steel siding, corrugated aluminum siding, or corrugated asbestos-cement siding on steel or reinforced concrete framework.

(5) Pre-cast architectural concrete panels erected by tilt-up or other methods of erection, used throughout.

(6) Common brickwork from foundation to window-sill level, in lieu of concrete blocks or cast-in-place concrete, with various wall combinations as noted to be used with concrete blocks or cast-in-place concrete.

(7) Concrete blocks finished with brushed-on Portland-cement wash or Portland-cement paint, used throughout the construction.

III. Outlying locations and structures of minor importance.

A. Station and office buildings.

(1) Timber framing with wood novelty siding or boxing and batten, framework sheathed or unsheathed according to requirements.

(2) Timber framing with wood novelty siding of not less than 2 in. thickness up to window-sill level, balance of construction being of rigid asbestos-cement shingles or aluminum novelty siding on solid sheathing of wood or other suitable sheathing material.

(3) Timber framing, solid sheathed with wood or other suitable sheathing material, finished with lathing and stucco.

B. Shop buildings, storehouses, freight stations, etc.

(1) Timber framing with wood novelty siding or boxing and batten, framework sheathed or unsheathed as necessary.

(2) Timber framing covered with corrugated-steel or corrugated-aluminum sheets.

(3) Pre-fabricated metal building on concrete slab, non-insulated or insulated according to use requirements.

(4) Timber framing covered with corrugated asbestos-cement siding.

(5) Concrete blocks finished with Portland-cement wash or Portland-cement paint used throughout the construction.

It should be understood, of course, that the above outline is to serve only as a means of generally classifying various possible and suitable types of construction.

It should also be understood that it is possible to work out any number of various combinations of the above general types and to work into such combinations, or into the described general classes, certain other items of construction materials, such as glass blocks, corrugated glass, porcelain-enameled steel sheets, mineral-surfaced asphalt-impregnated fibreboard, cedar or redwood shakes, and similar specialties, according to appearance requirements or other considerations applying to any certain structure.

The committee found that country-wide conditions applying to the matter of cost of construction were so varied as between areas, sections and localities as to preclude the presentation of cost data in form suitable for general application or in such form as would not tend to be misleading or confusing to those attempting to make use of this report in connection with specific projects. With respect to cost data, the committee can only recommend that each architect and designer be governed by personal experiences, modified as may be required by local market conditions, both materialwise and laborwise.

DISCUSSION

The discussion was begun by J. A. Jorlett (Penna.) who stated that, when unusual building materials are used, a small stock should be ordered in addition to actual immediate requirements so that replacements of broken or damaged materials can be made. As an example, he cited an instance where 6-in. by 6-in. glazed tile had been used for wainscoting and floor surfacing, and some of the tile over the floorbeams developed cracks and had to be replaced. The few tile left over from the original construction had been thrown away and new ones of the same size could not be purchased.

J. L. Dougherty (W. M.) brought out the fact that, because two different shipments may bring building tile of different color shades, it is better to request this material in one shipment. He asked how others replaced broken glass blocks in enginehouses. E. H. Barnhart (B.&O.) stated that he uses these blocks in panels 15 ft. square, placed in wood frames and muntins. In 10 years, he said, only one panel needed replacement and this was because an engine ran through it. President Huckstep said he had found that the use of a high-glazing compound in the original construction made it easier to make future single-block replacements. L. C. Winkelhaus (C.&N.W.) said he preferred to use the heavy wood frames and sash with wood beads for installing glass block because vibration from the engines affects putty and glazing compounds.

J. F. Warrenfells (S.A.L.) stated that whenever he had occasion to replace one broken glass block, two or three others adjoining were broken in the process so that four blocks had to be ordered

to replace one. He added that his road is now experimenting with the use of corrugated structural glass for enginehouse end panels. They seem to be holding up better than the glass blocks did and are more easily repaired. He further stated that he prefers the heavy creosoted wood frame for these panels instead of the metal frames. President Huckstep said he was interested in Mr. Warrenfell's reference to the corrugated structural glass because his road has used this material in the construction of a new $2 million freighthouse and finds that it provides good lighting.

Protection of Steel Bridges Against Brine Drippings

Report of Committee*

M. J. Hubbard
Chairman

• Many methods of protection from brine drippings have been tried, some in an experimental way, but there is still a large field for investigation. There are three principal methods for protection of steel bridges against corrosion resulting from brine drippings:

(1) Choice of more corrosion-resistant steels, such as alloy steels, high tensile steels or non-ferrous materials.

(2) Use of protective coatings: (a) Metallic coatings such as zinc or aluminum platings; and (b) other protective coatings and coverings.

(3) Corrosion inhibitors (polyphosphate nitrate mixtures).

Copper-bearing steel increases the corrosion resistance of the steel at only a slight additional cost, but it cannot be considered economically effective against brine drippings without a substantial protective coating. High-tensile steels of silicon or nickel and other alloy elements have been used in some special railway bridges during the past few years with very good corrosion-resistant qualities. These alloys naturally increase the cost of steel considerably and, as with copper-bearing steel, they cannot be considered economically effective against corrosion from brine drippings without a good protective coating.

Metallic Coatings

Metallized coatings, applied to the tops of steel girders by spray-gun process, have been used by some railroads where brine drippings from refrigerator cars cause heavy damage to steel bridge members. This process consists of spraying molten non-corrosive zinc or aluminum on thoroughly cleaned steel surfaces by using a special gun on the order of a spray gun. The non-corrosive metal feeds through the center of the gun's nozzle in the form of a wire. At the base of the gun there are attached three lines—one carrying compressed air, another oxygen and a third acetylene. As the metal wire passes out of the gun through the nozzle, it is transformed into a molten state by an oxyacetylene flame and is forced into a spray by the compressed air. The metal spray is cooled rapidly and is practically cold when it strikes the steel surface being coated, so the bond to the steel is more or less mechanical.

One railroad has made it a policy to metallize the top flanges of floorbeams, stringers and girder spans on all new bridges before erection at locations where subjected to excessive brine drippings.

The surface preparation is one of the most important factors in the metallizing process, especially when undertaken on top of an old girder that has been exposed to brine drippings, causing deep pits in the steel plates. The conventional steel-cleaning processes may be used, such as air tools, wire brushes, sand or shot blasting, and flame cleaning with oxyacetylene torches. Salt deposits in pits and pores in the steel are neutralized by the high temperature of the flame (3600 deg. to 3800 deg. F.), as salt vaporizes at approximately 2600 deg. F.

Other Protective Coatings

Many protective coatings for steel girders are in use today. Probably one of the oldest and most generally used is linseed oil paints, such as red-lead primers, because of the adherence of linseed oil to steel when covered with a protective paint or coating that will stand normal weathering.

Experience has shown that oil-paint coatings on steel will not withstand excessive dampness, brine drippings, acids, etc., due to the paint films being very porous, and, in order to protect steel from these highly corrosive conditions, it is necessary to use an impervious acid-resistant material for the coating. Such coatings can either be applied direct on the properly cleaned steel or over oil-paint coatings.

Proper cleaning of steel structures before painting is very important in order to insure the best bond of the paint film. If the cleaning and painting can be done before the metal becomes pitted, a satisfactory and economical cleaning job can be done with pneumatic chipping hammers, steel hand scrapers, hand and electric wire brushes and disc machines; however, if the painting has been deferred to such an extent that the corrosion and deterioration is very prominent, then the sandblasting method of cleaning should be used in order to get a satisfactory cleaning job.

All cleaned steel should be given a primer coating immediately after cleaning, as oxidation forms a light rust coating over night on exposed steel surfaces. Red-lead or chromate primers applied in one or two coats, then covered with a coat for weathering, have been used by most railroads for normal protection. Where brine drippings are involved, the painting cycle on portions of girders has to be stepped up for protection of steel, or an added protective coating applied over oil paints to extend the paint cycle.

Spot Painting Satisfactory

Periodic spot painting of bridges exposed to heavy brine drippings has proven very satisfactory as there are portions of girders that will probably run a six- or eight-year paint cycle, yet, to protect other portions, spot painting will be required every two or three years due to local conditions. Corrosion from brine drippings on some railroads runs the cleaning cost up 200 to 300 per cent over bridges exposed only to normal corrosive conditions.

Oxyacetylene flame cleaning has been used to very good advantage by some railroads on bridges where it is desired to remove all the old paint from girders, including the original shop coat on steel. Flame cleaning is not economical on some girders with certain types of paints that are not too old and where a substantial portion of the coating is intact as the flame seems to set the paint on steel, making it very difficult to remove with tools.

One of the coatings being extensively used by a number of railroads is a heavy non-hardening chemically inhibited compound of grease-like consistency, containing a solvent for ease of application. This material is applied with a stiff bristle brush or spray in order to insure a good bond between it and the steel or oil-paint coating. The thickness should be about 1/16 in. applied only on portions of beams or girders where the coating will not be broken, as it is a non-hardening compound.

These materials have found good usage on steel girder plates, tops of floor-

*Chairman of this committee was M. J. Hubbard, general supervisor bridges and buildings, Chesapeake & Ohio; vice-chairman was M. D. Carothers, assistant chief engineer, Gulf, Mobile & Ohio, Bloomington, Ill.

J. S. McCauley, assistant division engineer, S. P.; F. E. Gladwin, bridge and building superintendent, N. W. P.; H. R. Demmon, assistant general bridge inspector, S. P.

W. R. Graham, assistant supervisor bridges and buildings, C. & O.; C. F. Martin, manager Chicago office, Timber Engineering Co.; R. L. Fletcher, structural engineer, Timber Engineering Co.

beams, laterals, lateral plates, top and bottom flange angles, webs, struts, cross frames, fixed and expansion bearings, roller nest, rockers and finished bearing surfaces; also as a protective coating on turntables, used by steam engines at terminals, as these tables are subjected to an excessive amount of chemically treated water from steam locomotives.

Asphalt coatings have also been used by a number of railroads as a substitute for paint in the protection of steel bridges against corrosion. This material is applied as neat asphalt, put on hot, or in the form of asphalt oils containing from 57 to 65 per cent asphalt by weight, which gives a fairly economical protection from normal corrosion. However, for excessive brine drippings the neat asphalt is recommended, applied in heavy brush coats, as its melting point of 150 deg. to 170 deg. prevents the asphalt from running in hot weather and cracking in cold weather.

Some railroads have given protection to top cover plates on open-deck bridges by the application of tapered or roof-type wood blocks between bridge ties over girders or beams. These blocks are sealed in place with asphalt, tar, or some compound that will shed the brine drippings. Galvanized iron troughs are sometimes used between bridge ties to shed or deflect brine drippings from the tops of beams or girders.

Corrosion Inhibitor

The annual corrosion loss to the railways from the damage done by brine drippings cannot accurately be evaluated, but it has been estimated that the damage to track and bridge structures probably exceeds $8,000,000 annually and the damage to the refrigerator cars is perhaps one-half of this amount.

Extensive tests were undertaken by the Association of American Railroads to find a corrosion inhibitor that could be used with salt when icing refrigerator cars, which would effectively protect the track, bridge and car structures from brine corrosion. The most promising inhibitors tested were sodium polyphosphate and disodium phosphate, the indications being that their use would result in a reduction of approximately 68 per cent in the corrosion rate.

More research must be conducted before definite recommendations can be made for the use of inhibitors in icing refrigerator cars; however, the results of the research work are very promising and indicate that a substantial reduction may be made in the annual corrosion loss by railways due to brine drippings from refrigerator cars, which will save the industry several millions of dollars annually.

Conclusion

Methods of protection of steel bridges from brine drippings are varied and their effectiveness depends greatly upon the character of the structure, local conditions and extent of corrosion. The use of more corrosion-resistant materials will retard the corrosion from brine, and the application of protective coatings, of either metallic or other types, on parts of steel structures, will minimize the extent of corrosion. In the application of metallic or other coatings, a clean dry surface is very essential.

The use of a corrosion inhibitor with the rock salt employed in icing refrigerator cars may, after further study, help solve the problem of steel corrosion caused by excessive brine drippings.

DISCUSSION

Chairman Hubbard began the discussion by announcing that a committee of the A.R.E.A. had been studying this subject for a number of years and is still working on it. He then asked if anyone had solved the problem on his road. L. Garis (C.&N.W.) stated that, while his road had not solved this problem, he did inspect a bridge where the bridge foreman had applied a tarpaper covering over a floorbeam and that after many years of service this floorbeam was in very good condition as compared with other floorbeams not so protected. He added that he recalled where a foreman had sent him two lag screws, one that was galvanized and another that had not been coated, from the same structure. The galvanized lag screw was in excellent condition while the other was of the size of a lead pencil.

It has been the standard practice for 15 years on his road, said F. M. Misch (S.P.), to use galvanized bridge hardware along the seacoast routes.

Chairman Hubbard asked if any members could describe the brine-protection tests being carried out on their roads, and this prompted several members to advise that the A.A.R. is conducting these tests. R. E. Dillow (A.A.R.) stated that he is assisting in making these tests and that, in addition to the galvanized coatings, extensive tests are being conducted with paints. R. Baker (Nat. Lead Co.) said that the problem of protecting steel bridge members with paints had also been referred to his company. As a result several of the more modern types of paints, including vinyl and synthetics, are being tested on several railroads.

W. L. Short (M.P.) stated that he knows of some synthetic paints being used by European railroads but he was unaware of any use of these paints on roads in the United States. He said that sodium chloride, even when merely present in the environment, will cause rapid oxidation of metal. The problem is severe where brine drippings fall, especially in dry territory. In applying paints, Mr. Short believes that the most important factor for obtaining good protection is in the preparation of the surfaces. The film thickness or number of coats is also of importance, because, while all coats are porous, each one helps in closing pores in the coat beneath it.

Mr. Short said that there is more than one way to cause rust. Mill scale is not rust in itself, but rust forms beneath it. Rust from salt on iron is hydroscopic and holds moisture to hasten corrosion. Salt must be removed to reduce corrosion, but chipping hammers and scaling brushes won't do it, and some other method must be used. He has noted that ties resting on girders or steel members cause corrosion, and these places are harder to protect because they are difficult to paint. Hydroscopic rust is in no respect a protective coating in itself. Rusting is rapid in the early weeks of its formation and then it tapers off in growth.

Early in 1929, Mr. Short continued, it was clearly demonstrated that an environment containing salt requires paints with alkaline-resistant vehicles. Synthetic paints look promising but he does not advocate their use in general bridgework. They should be used only in salt atmospheres and areas. He stated that he was not satisfied with the service life obtained from the coatings now in use on his road, with the exception of the metallic coatings which so far are giving excellent results. He knew that the Northern Pacific was also obtaining good results from metallic coatings. When his road first started using these coatings, it was often expressed that a short service life only could be expected because the electrons of the zinc would be lost to the steel, or wasted. He added that vinyl and chlorinated rubber coatings may be good for sealing the metal surfaces.

Construction of Diesel Fueling Facilities

Report of Committee*

• The increasing use of diesel motive power on the American railroads requires continued study to attain the best and most economical methods of storage of fuel oil. The selection and location of tanks and equipment to store this fuel oil is essential. Adequate facilities for delivery of the fuel oil to the locomotives with a minimum of delay are of primary importance. The subject matter of this report will be devoted primarily to the design and construction of fuel-oil facilities.

K. E. Hornung
Chairman

Design and Planning

The strategic location of fuel-oil installations is closely related to train operations. They are usually placed at intermediate terminals not more than 200 to 300 miles apart for diesel locomotives in freight service. The location of these facilities adjacent to passenger-station platforms will permit their use in servicing passenger-train locomotives while the train is being handled during normal scheduled stops.

The capacity of fuel-oil storage is often limited by restrictions as to the area available for the location of storage tanks, but it is very desirable that the tanks have a minimum capacity equivalent to a 30 days' supply and preferably 60 days.

Another important consideration in the design of the diesel fueling installation is the time required for the fueling operation. The pumps should be adequate to provide a minimum of approximately 100 g.p.m. for each of the units to be serviced simultaneously, and the piping should be such as not to restrict the flow of the fuel.

At this point it is well to comment on the mobile fueling facilities provided by a number of railroads for use in servicing diesel switch locomotives assigned to various yards throughout metropolitan areas. Such facilities consist of an automotive tank truck equipped to dispense diesel fuel oil, water and sand. With such equipment, the servicing operation is brought to the locomotive and accomplished during the lunch period or when the engine crew is being changed, with a minimum of lost time to the crew or the engine.

Storage tanks should be of welded steel construction, of gauges to conform to state or local codes. Where such codes do not exist the minimum standards as established by the National Board of Fire Underwriters should apply.

Storage tanks with capacities up to 35,000 gal. are usually prefabricated, since these sizes can be handled as normal shipments and installed with regularly available equipment. Often tanks having a capacity of less than 35,000 gal. can be installed underground more economically than above ground where space may be at a premium and existing structures might require expensive dike or fire-wall construction. Tanks placed underground must be of heavier gauges and provided with some means of ballast to prevent floating. An effective form of ballast is to pour a concrete slab over the top of the tank, providing from one-half to one cubic yard of concrete per 1,000 gal. of capacity, depending on the maximum fluidity of the soil when saturated.

The prefabricated tank, when installed above ground, is either placed horizontally on the required number of supporting cradle walls or saddles, or vertically on a crushed stone or concrete base. When such tanks are placed vertically the problem of providing stability under wind loads must be given consideration, and provision made for anchorage if calculations indicate such is required.

Tanks having capacities greater than 35,000 gal. are erected at the site and placed on a bed of well-graded crushed stone and sand extending several feet beyond the circumference of the tank. The area surrounding the tank bed should slope away from the tank to provide good drainage.

Horizontally placed tanks should be provided with a manhole, inlet and outlet coupling, gauge coupling, vent-pipe connection, and level indicator, all these openings to be placed on a line on one side of the tank for top setting. In addition a coupling for a drain and sampling connection, for bottom setting, should be provided on the opposite side near one end.

Vertically placed tanks should be provided with a manhole and couplings for escape valve, vent and level indicator in the roofs. On the side near the bottom should be a manhole, and couplings for inlet, outlet, sampling connection and level indicator. Each tank should also be provided with ladder and safety cage as required.

The construction of dikes surrounding all above-ground diesel fuel-oil tanks is recommended to protect adjoining railroad property, even though not required by state or local codes. Where multiple-tank installations are made, tanks having a capacity of greater than 25,000 gal. might well be individually isolated by dikes. The volume of the diked area should be 110 per cent of the volume of the tanks, including that part of the tank below the top of the dike wall, unless this requirement is exceeded by state or local codes.

Dikes may be constructed of earth or concrete, and diked areas should not be provided with any drainage other than the natural porosity of the earth.

Pumps of either the centrifugal or rotary types, equipped with totally enclosed motors of such capacity as will develop the full rated discharge capacity of the pump, are used in diesel fuel-oil service. The centrifugal type pump is very satisfactory for this service when the suction is limited to a relatively low lift, for example, when used to pump from a vertical storage tank to fueling stations. The rotary type pump, equipped with relief valve and by-pass, being of positive displacement, is used where conditions require dome unloading of tank cars, etc., and where self priming is not possible.

To limit the time required to fuel the diesel locomotive to the minimum, pumps of at least 200 g.p.m. have been generally accepted as the proper capacity for this service. With proper arrangement of piping and valves, the same pump may be utilized for conveying the fuel oil from tank cars into storage tanks and from storage to servicing stations. Though multiple pumps may be required to facilitate the unloading of cars at the same time locomotives are being fueled, proper piping will prevent fueling interruption due to a pump failure.

Pumphouses and Appurtenances

A pumphouse, of adequate size to accommodate all pumps, filters, meters, piping and valves, should be provided. The pumphouse should be of non-combustible materials with good ventilation and drainage to the outside.

Since Diesel fuel is a very difficult liquid to handle without encountering leaks through gaskets and pipe threads, special attention should be given to the piping. Where the piping is of black steel pipe, the joints should be either carefully welded or screwed, using a specially formulated pipe thread compound to prevent oil leaks. Where pipe lines are of the larger sizes, and cast iron or spiral-welded steel pipe is used, patented bolted joints using neoprene gaskets have proven very satisfactory.

Pipe connections at valves, pumps, filters, meters, etc., can usually be best provided with flanges having gaskets designed for oil service and coated with an oil resisting gasket paste before installation. All pipe lines should be given a hydrostatic test at pressures of 150 per cent of the designed operating pressures. Valves should be of the wedge-gate type having an operating pressure of 125 p.s.i.

*Chairman of this committee was K. E. Hornung, architect, Chicago, Milwaukee, St. Paul & Pacific, Chicago; vice-chairmen were G. Switzer, assistant division engineer, Western Pacific, Sacramento, Cal., and H. B. Lorence, fire protection engineer, New York Central—Indiana Harbor Belt, Gibson, Ind.

P. E. Scites, assistant supervisor bridges and buildings, H. M. Harlow, assistant general supervisor bridges and buildings, both C. & O.

J. F. Marsh, engineer of bridges, C. R. I. & P.; C. H. Sandberg, assistant bridge engineer, A. T. & S. F.

These valves should have a neoprene or oil-resistant packing. Lubricated plug-type valves are also suitable.

A strainer should be provided in the suction line ahead of the pump, having a 30-mesh removable-type screen to protect the pump from foreign matter. A filter placed on the discharge side of the pump will, if the pump is used for both unloading cars and pumping into the servicing hydrants, provide double filtration of the fuel oil. The filters so used should be designed expressly for this service, with renewable-type filter elements.

Good accounting practice recommends the use of meter installations to record the amount of fuel oil unloaded into the storage tank as well as the quantity placed in locomotive fuel tanks. If the locomotive fueling hydrant outlets are located some distance from the pumping and unloading facilities, meters for the latter purpose should be provided as a part of the fueling hydrants. Air eliminators installed in conjunction with the meter will result in more accurate metering.

Hydrants; Unloading Facilities

There are many variations in the design of diesel fueling hydrants, but the most widely used has a standpipe, 10 to 16 ft. high, with a neoprene hose extending from the top of this pipe and having, on the opposite end, a spring loaded quick-acting type fueling valve and a half-turn quick coupler to fit the diesel fuel tank. The standpipe has a gate valve in line located about five feet above the platform for positive closure. At each standpipe may be located the meter as referred to previously, as well as a pilot-type remote control push-button station for controlling the starting and stopping of the pumps.

Since the National Board of Fire Underwriters has recommended dome unloading railroads are more generally adopting this type of unloading of tank cars. The simplicity of bottom outlet unloading equipment may not outweigh the accompanying hazards.

Where the bottom outlet unloading is used, a pit or box for the storage of hose and for the piping connection is relatively simple in design. The hose used is usually of neoprene with wire reinforcing, and has a standard connection to fit the bottom outlet of the car.

Dome unloading requires a crane, of which there are many designs. Most all of the cranes follow a general pattern consisting of a vertical pipe approximately 10 ft. high located within legal clearance from the center line of the unloading track. At the top of the vertical pipe there is a hinged or swinging joint with a horizontal pipe for extending to the center line of the track. A removable section of pipe for extending the horizontal arm into the bottom of the tank is provided. The removable section of pipe, or arms not counterbalanced, should be of lightweight non-ferrous metals for ease of handling. All swing joints should be of types which provide easy movement and are not affected by oils.

All inside electrical work in connection with diesel fueling installations should be of types to meet the National Electrical Code for Hazardous Installations. Lighting within pumphouses should use explosion-proof type fixtures. Conduit should be of the rigid type and lighting switches and motor controls, if inside the pumphouse, should be of explosion-proof types. Switch gear, if located on the outside of the building, should be weatherproof. All electrical work should be properly grounded.

As the fueling operations are on a 24-hr. basis, adequate floodlighting of the servicing operations is of utmost importance. Lighting of the tank-car unloading areas is usually of secondary importance as these operations are carried out during the day shift.

As most railroads have their individual requirements as to fire-prevention standards, recommendations in this sphere might be of a controversial nature. However, diesel fuel oil is not in the low flash-point group of inflammable liquids and it is usually sufficient to provide dry-type chemical or CO_2 extinguishers, except where state or local codes require installation of specific types of fire protection, such as built-in foam systems.

DISCUSSION

F. M. Misch (S.P.) began the discussion by pointing out that, in making an inspection of a large fuel-oil storage tank, he found that the bottom plates were paper thin from corrosion and that the heavy deposit of oil sludge no doubt was all that prevented leakage. He warned that it was just as possible to have this corrosion in the pipe lines and that this should be kept in mind when making inspections. He said he differed from the report in one respect in that he preferred to have the tanks set on sand that was oil-impregnated under pressure rather than on gravel or crushed stone. He also warned that economy can be carried too far in re-using old steel water tanks, because when diesel oil is placed in an old riveted steel water tank, there is danger of leakage.

In response to a question by J. A. Jorlett (Penna.) as to how the northern roads kept diesel oil warm so that it presented no pumping difficulties, Vice-Chairman G. Switzer (W.P.) replied that he has found electric heaters to be satisfactory and that they presented no serious fire hazard. H. B. Lorence (N.Y.C.) added that his road likewise uses electric heaters for this purpose and that they are of the explosion-proof type. L. R. Morgan (N.Y.C.) stated that electrical strip heaters would be dangerous to use for warming diesel oil pipe lines, etc., and recommended that the association go on record as being opposed to their use. However, no vote was taken on this recommendation.

L. Mayfield (M.P.) stated that it frequently costs more to make a riveted tank oiltight by welding than to buy a new tank. In welding old tanks, the welded material applied generally breaks as the work progresses. To this, G. W. Benson (C. of Ga.) stated that he has had several old tanks welded but did not experience Mayfield's difficulty with breaks.

C. E. Garcelon (B.&A.) stated that much to his later sorrow he used conventional pipe joints on some of his underground oil supply pipe lines. It was his opinion that pipe lines with conventional joints should be used above ground where they could be inspected for leaks or else welded joints should be used on underground lines.

President Huckstep (M.P.) commented on the lack of anchorage for oil-storage tanks and recounted how such tanks floated away during the floods recently experienced at Kansas City, creating serious fire hazards. He predicted that proper anchorage of oil tanks might soon be required by law. G. Martin (I.C.) said that he had overcome the possibility of tanks floating away during a flood by installing check valves near their bases which permit water to enter the tanks and the levels to become equalized within and outside of the tanks. He admitted that if the water rose to any considerable depth, this anchorage method would cause loss of oil but, on the other hand, if the tanks were not anchored, the oil would be lost anyway.

Economies in Maintenance and Operation of Heating Plants

Report of Committee*

• Maintenance and operation of heating plants on the railroads are large items of expense. No doubt there are many old plants in service that are antiquated, and if a study is made it would be found that replacement with a modern plant would be economical from the standpoint of both maintenance and operation. When the 40-hr. week became effective it was desirable to convert coal-burning heating plants to use oil or gas to eliminate the need for manual attendance on week-ends. In many cases the oil or gas-burning unit was installed in the old steam, hot-water or hot-air furnace. The fire box was originally designed to burn coal and it may be questioned if such plants can be operated efficiently with oil or gas.

Economies in fuel consumption may be made by re-arranging piping and installing circulating pumps for hot-water systems and remodelling ducts and installing blowers for hot-air systems. This, of course, is dependent on electricity being available for the pumps or fans. The chimney or stack also has a bearing on fuel consumption and the chimney or stack is also involved at locations where smoke abatement is in effect. It is advisable to check the capacity of the chimney or stack with a draft gauge. Manufacturers generally specify the draft required. It is important that oil-burning stoves have the proper draft.

Another factor in reducing fuel consumption is proper insulation of the boiler and piping, as much heat can be lost if insulation becomes defective. In this connection, the construction of the building being heated has a lot to do with fuel consumption. Obviously, a well-built, properly insulated building will require less fuel to heat than some of the old, poorly insulated buildings in use on the railroads.

Those of us in the northern climate especially know the importance of having the heating plants in a dependable operating condition. The failure of a heating plant at one of the larger places may be costly. Failure can be reduced to a minimum by proper maintenance and operation.

In order that a heating plant may have proper maintenance, the inspection is the first step. Before the heating season is over a visual inspection should be made of steam and hot-water piping, valves, radiators and any other parts that need attention and in which defects cannot readily be detected when the plant is cold. When the heating season is over a thorough inspection should be made and needed material assembled so that repairs can be made before the next heating season. Consideration should be given to the use of welding in connection with repairs. In many cases pipe and fittings and parts for the heating plant can be repaired by modern welding at much less cost than that of new parts.

V. E. Engman
Chairman

There are many parts to a heating plant and each part is equally important in the functioning of the plant. The following is a guide for the inspection.

Arrange for a hydrostatic test of all boilers, as state or local statute requires, or as may be required by the railroad, and wash the boilers. Boilers not requiring a hydrostatic test should be drained and as much as possible of the sludge washed out. It seems that manufacturers could provide more openings in sectional boilers to do proper cleaning and inspecting. Soft water should be used for all steam boilers, especially sectional boilers. Where treated locomotive water is not available, a separate water softener may be desirable. When the boiler is refilled it may be advisable to add a rust inhibitor. Clean the fire boxes and examine the lining and grates and clean and examine tuyeres and retorts if stoker fired.

Clean and examine the smoke-pipe connection to the chimney or stack, the dampers and the barometric draft control. Clean and examine the chimney. A defective chimney not only interferes with the draft, but is a fire hazard.

Take apart stokers to examine the feed screw and housing, the gear box, bolts, and hopper, and inspect the motor. Filling the feed screw with oil-soaked saw dust will prevent deterioration of the housing. Painting or oiling the steel portion of the stoker as well as the boiler will prevent rusting.

Take apart, clean and, if necessary, repack the condensate pump, and clean and inspect the motor. The same applies to water circulating pumps in hot-water plants.

Where the plant is an automatic oil-fired unit, clean the nozzle and igniter, and examine the fuel pump and oil strainer. Clean and inspect the motor. Take apart, clean and examine the automatic water feed, and clean the water glass and valves. Test pressure gauges, relief valves and cocks.

Examine radiators, radiator valves, air valve, traps, insulation, pipes and fittings, including the water inlet pipe; also the pressure-reducing valves and motorized valves, including the motor. Open up where necessary for proper inspection. Examine the expansion tank.

Water softeners should be cleaned and examined. Automatically operated plants, in particular, need close attention. Clean hot-air furnaces and examine sections, grates, doors, housing and ducts. Replace air-filter where one is used. Where a blower is provided, examine the bearings and belt, and clean and inspect the motor.

Unit heaters are generaly located near the ceiling and are frequently neglected. These should be inspected and motors cleaned and tested.

Coal-burning stoves are easily inspected for defective parts. Many coal stoves have been replaced with oil, gas or electric stoves where heat is required during week ends for patrons, to protect perishable goods, or to prevent plumbing from freezing. About the only attention oil stoves require is the cleaning of the pilot ring and baffle, the oil regulator, the screen and the tube from the fuel tank. If the unit is heavily fired the pilot ring and baffle may burn out. Trouble from foreign substance in the oil can be prevented by installing a sediment bulb next to the fuel tank if the oil is stored in an outside tank. Savings can be made in fuel by providing thermostat control for the oil regulator and a fan for circulation. Where the heater is located in the waiting room of a depot that has to be kept open when the attendant is not on duty, trouble from outsiders regulating the valve can be avoided by placing the oil valve in the office or constructing a cage around the valve, which can be locked.

Inspection of the various electric motors should include wiring, and all electric controls, switches, starters, stack and temperature switches, float switches and thermostats. For uninterrupted service of a heating plant, the electric controls are perhaps the most important. Cause of failure of an automatically controlled heating plant is most frequently of an electrical nature.

There are many domestic type hot-water heaters on the railroads and they come in the same category as heating plants. These units should have the same thorough inspection as the heating plants. No doubt some economies can be effected by replacing coal or oil heaters with modern gas or electric water heaters. Where electric water heaters are used it is imperative that the heating element be removed and cleaned periodically to maintain its efficiency. Encrustation may build up on the unit to the

*Chairman of this committee was V. E. Engman, chief carpenter, Chicago, Milwaukee, St. Paul & Pacific, Savanna, Ill.; vice-chairmen were R. W. Humphreys, division engineer, Northern Pacific, Missoula, Mont., and N. H. Williams, bridge and building master, Delaware & Hudson, Oneonta, N.Y.

extent that it will be difficult or impossible to remove the unit without damage.

Heating plants are always a fire hazard from various causes. Where the heating plant is housed in a separate room the fire hazard can be reduced by lining the room with fire-resistant material, keeping the room clean and free from combustible material and providing dependable fire extinguishers. Where oil is used, provide foam, dry powder or CO_2 type extinguishers. Where the heating plant is located in an open room good housekeeping should prevail. If the plant is properly installed and insulated and the room kept clean, the fuel and ashes handled carefuly, and drafts regulated so the unit does not overheat, the fire hazard is reduced to a minimum.

The storage of fuel oil is a problem in many places. Where space and regulations permit the storage tank should be located above ground. The use of oil heating is quite universal and truck delivery of oil is available in cities and small towns. Consequently, a tank above ground, with a capacity that does not require a dike, can be used. The objection to an underground tank is that it is not accessible for inspection and, if a leak occurs, serious consequences may result from the oil seeping into the ground. Furthermore, water from the ground may get into the tank.

With the mounting cost of fuel, the economical operation of the heating plant is of utmost importance. If, by careful firing and elimination of unnecessary heat, we could save one ton of coal or 100 gal. of fuel oil for each heating unit during one season, the money saving can readily be figured.

Overheating causes waste of fuel, and is detrimental to the heating plant, adds to the deterioration of the interior decoration of the rooms and is a fire hazard. Rooms are often heated to 80 deg. or more when 70 or 72 deg. would be comfortable. With hand-fired coal-heating plants the tendency is to overload the fire box to save extra trips to the coal bin, the grates are not shaken, clinkers not removed and the ash pit not cleaned, all of which result in unnecessary fuel consumption. For successful operation of stoker-fired heating plants the clinkers must be removed regularly. Holding water in boilers to proper level adds to the efficiency of the plant. Oil or gas-fired heating plants are adapted to closer regulation than coal fired. When equipped with thermostatic control or manual control, the temperature can be lowered during nights and week ends when the building is not occupied.

Efficiency can be obtained in the operation of heating plants if the operator of the plant has full knowledge of how they should be operated. The printed instructions furnished by manufacturers, supplemented by such instructions as may be issued by the railroad, should be posted at the heating plant. Officers and supervisors should insist that these instructions be obeyed. We must educate the railroad employee to become fuel-saving conscious—that fuel, whatever it may be used for, is not a cheap commodity to be wasted.

DISCUSSION

President Huckstep opened the discussion by asking if anyone had figured out how to turn cold water into a hot boiler that had no water in it. When no one in the audience responded, Mr. Huckstep said he guessed that the automatic feedwater system is the only solution.

In response to a question raised by R. E. Dove (R.E.&M.) as to whether or not any saving resulted from turning the thermostat dial down at night when the walls had to be reheated the next day, Chairman Engman replied that there was, providing that the dial was not set lower than 60 deg. at night.

G. S. Crites (B. & O., retired) stated that the matter of standardizing furnaces used to heat small buildings is important as it will save in the cost of storing replacement parts.

Accident Prevention in Maintenance and Use of Work Equipment

Report of Committee*

• In considering the problem of accident prevention prior to any undertaking, regardless of its size or type, there are two goals which must be achieved to insure safe completion of the job. They are: (1) the education of the workmen and the machine operators; and (2) an experienced and intelligent supervisory force. The extent to which these men are trained will determine the safety record for the job.

The education required for the workman is on a very broad and continuous basis. The workman must recognize the importance of his own personal safety, the safety of his fellow workmen, and the safety of the public. The phrases "Safety is the first importance in the discharge of duty," and "Obedience to the rules is essential to safety," are both familiar to every railroad man. Unfortunately, these phrases are so familiar they only remind each man that he has read the General Notice in the Book of Operating Rules. The underlying idea behind these phrases does not strike each man personally as effectively as it should, as far too often men allow themselves to feel that the phrases are meant for the other men, with the result that they treat them indifferently themselves.

R. L. Fox
Chairman

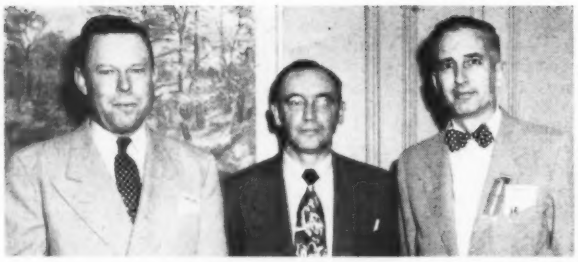
The first step in educating the workman is to impress him with the realization that he himself can have an accident. He must be able to picture himself disabled and the tragic results to his loved ones. He must realize the importance of working safely and that through a careless act or unnecessary chance he can not only injure himself but his fellow workmen, or someone not even connected with the railroad. With this idea firmly established, he will automatically become more safety minded.

But being safety minded is not enough. Many an accident is the result of ignorance in the use of materials, tools and machinery. This is the second part of the education of the workman. A man must be taught the safe way to use his tools and how to handle material without hurting himself or someone else. He must be taught how to keep his tools in good working condition and how to recognize when these tools are in such a condition that their use would create a hazard.

A machine operator must know every aspect of his machine—its capacity, proper maintenance, operating signals, and safety regulations—as well as have practical experience in its operation. Consequently, through experience and training the workman gains confidence in himself and his fellow workmen. This confidence is very necessary, for a man cannot be completely safe if he has to hesitate or if there is a doubt in his mind that he is not doing the job right.

The state of mind of the workman is likewise important. He cannot work safely if his mind is not on the job, nor

*Chairman of this committee was R. L. Fox, division engineer, Southern, Alexandria, Va.; vice-chairmen were E. L. Collette, division engineer, St. Louis-San Francisco, Ft. Smith, Ark., and F. F. Hornig, division engineer, Chicago, Milwaukee, St. Paul & Pacific, Mason City, Iowa.



W. J. Savage, assistant chief engineer, T. & P.; H. H. Kruse, chief carpenter, C. M. St. P. & P.; R. R. Gunderson, assistant bridge engineer, Sou.

L. C. Hinsch, chief carpenter, C. M. St. P. & P.; C. P. Benning, sales representative, Fairmont Railway Motors; B. E. Daniels, division engineer, C. M. St. P. & P.

can he be safe if he becomes overconfident. The foregoing reasons obviously bring out the second essential point in accident prevention—proper supervision. The supervisory forces must not only educate and train the men in safety and practical know-how of the job, but they must also take a personal interest in the men to such an extent that the work will be assigned according to the ability and aptitude of the workmen. A man must not be put on a job beyond his physical or mental ability. Likewise, he must not be put on a hazardous job if he has any personal problem which would divide his attention.

The foreman or supervisor must himself be well versed in the know-how of the job. He must be thoroughly acquainted with the capacity of the machines and their safe load. He must supervise the actions of the men regardless of their experience, as they may become careless or take a chance, and by so doing the risk of an accident is increased. It is the responsibility of the supervisory force to prevent any such action and to inspect the tools and machinery to see that they are in proper condition. It is particularly important to check such parts that wear readily and parts that are under excessive strain. The organization of the work and the mutual understanding of what is to be done are the major responsibilities of the supervisor. With good organization the work will progress more smoothly and, as a result, more safely. Equally important is the understanding among the men as to what is to be done and in what order. Closely related to this subject is the mutual understanding of signals, particularly where their use is required involving movement where vocal instructions are not understandable due to the noise of machinery or local conditions.

A man may be the best trained both in ability and safety and have the closest supervision, yet he cannot be any safer than the most dangerous tool or machine that is at his disposal. In this respect, the responsibility moves up the line to the purchasing and testing departments. When buying machinery, it is not only necessary to investigate the resulting production and the maintenance cost incurred by the machinery, but it is absolutely necessary to investigate the hazards in its operation. The test department should provide information, if it is not already provided by the manufacturer, as to its proper lubricant, and specifications for replacement parts, and also designate points of excessive stress that should be inspected periodically. The most efficient yet the safest machine must be bought, and the hazards incurred in its use and maintenance must be brought to the attention of the men and supervisory forces.

Safety and accident prevention comprise a field in themselves. Yet this field is inter-related with every department of the railroad. To discuss the problem of accident prevention in any one phase will undoubtedly bring in topics of other fields, yet accidents can be traced back to parent causes regardless of the department. On the surface each accident is different, and the remark is often heard afterwards: "I never saw anything happen like that before"; but regardless of where or when or under what circumstances it may happen, if you go back far enough you will find that it resulted from one of several simple mistakes.

The most common mistake that occurs is in the personal protection of the men. The mistake usually involves just a little thing that would protect a man from being injured. One of the most frequent types of injury to the workman is caused by dropping material or equipment on his feet or hands. Although the cause is probably due to improper handling, the injury could possibly be prevented in the case of his feet, for example, if the man were wearing safety shoes.

It is the desire and goal of every management to remove the cause of accidents. Even though progress is being made in this direction, accidents are still happening. Yet with the safety measures provided today, it is possible to reduce the injuries from these accidents. For example, goggles should be provided for workmen engaged in using welding or grinding equipment. Masks should be provided when entering tunnels after blasting to protect the men from any fumes that might remain in the tunnel; likewise, they should be provided for men engaged in painting with a spray gun in order to prevent inhaling the mist of paint.

Helmets are also necessary equipment where there is a chance of material, tools or rock falling on the workmen. This is particularly true when they are engaged in tunnel work where men are continuously working above each other. This is likewise true in steel bridge construction where there is a constant danger of falling objects.

Another type of injury that is all too frequent occurs as a result of falls. In most every type of construction or maintenance work connected with the B&B department the workmen must place themselves in precarious positions to perform their work. In every case it is necessary to provide equipment for their protection. In some cases a safety belt will be sufficient, but in the majority of instances it will be necessary to build staging or scaffolding. This is true in such cases as tank, bridge, and building construction or maintenance. In building these scaffolds the particular job must be considered in selecting the materials and in determining the size and strength. It is necessary to make the platforms large enough so the men will have sufficient room to work without interfering with the other men. It must also be large enough to handle the material and machinery necessary for the job. In this connection, it is essential to construct the scaffold or staging strong enough to hold any load that might be required in the course of the construction, including wind stresses. To insure the safety of the workmen, railings and toeboards should be included on the scaffold.

The weather conditions must be considered in this type of work. In windy or icy weather special care should be taken to insure the safety of the workman. With high winds blowing, materials and tools may be blown off and there is a constant danger of a man losing his balance and falling. Ice presents somewhat of the same problem in that the footing and hand grips are insecure. Shoes with spikes to prevent slipping are sometimes useful, but if the weather conditions are considered bad enough it is wise to discontinue such work until these hazards are gone. However, it is found that good working conditions such as good light, heat (when possible) and protection from the wind, promote better relations and better safety records.

Tools and Machinery

Through the use of machinery and power tools the railroads have increased the quantity and the quality of their work. Equally important is the fact that these tools and machines have increased the safety of the men working on the job, but if these machines break down or are in bad condition the efficiency is greatly reduced. Likewise, if this condition is allowed to remain, it comprises a

C. C. Sims, supervisor bridges and buildings, C. & O.; H. D. Curie, master carpenter, B. & O.

L. C. Winkelhaus, architectural engineer, C. & N. W.; V. E. Engman, chief carpenter, C. M. St. P. & P.

deterrent to the safe operation of the machine. Consequently it is necessary to make daily inspections of the machinery before it is put into operation. This is true of every tool or machine used, and particularly of heavy equipment such as cranes, pile drivers and draglines. The operator should take a personal pride in his equipment and see that every part is in working condition and that there is no point that is liable to fail during its operation. For example, on such equipment as cranes or draglines, connections on mechanical parts must be checked. All bolts, nuts and cotter keys must be tight and in place. Pins must be inspected and sheaves must be free from defects or worn flanges and properly aligned to prevent excessive wear on the cables. The cables should be given special attention. All kinks and twists should be avoided, and proper lubrication maintained at all times, particularly on reserve cable retained on the drum.

Adequate inspection of the machinery involved should also be made, with special attention given to the gears and brakebands. In the actual operation of the machine, care should be taken, by consulting a capacity chart, to see that no part is overloaded, and that no excessive strain is placed upon the cables or boom by too rapid application of the brakes while the boom is extended. If the loads are large, the boom must be handled with care in order to prevent overturning the crane. If there is any particular danger in this respect, the crane should be blocked and equipped with outriggers. Workmen engaged around these machines should take particular care of swinging loads and always keep themselves clear of the machine. In the use of the pile driver, the operator or supervisor should see that the hammer is placed correctly in its leads and that the workmen are clear during this operation.

In the case of track cars and motor vehicles an inspection is also necessary before their use. Each railroad has its own regulations concerning their maintenance and operation but the difficult part of this situation is in the enforcement of the regulations. In order that the most economical and safest use be made of those vehicles they must be maintained correctly, and this point should be stressed upon the operators. For example, the oil must be changed at the proper intervals, the vehicle greased as specified, and the proper use emphasized. Excessive speed must be avoided, overloading prohibited and, last but not least, the machine must be kept clean. In the operation of track cars two things must be emphasized: (1) the proper inspection must be made of such things as rail sweeps, wheels, brakes, wheel flanges, gasoline leaks, and especially flagging equipment; and (2) when occupying the main line a line-up must be obtained and sufficient time allowed to clear all trains. In this case especially the rule "Obedience to the rules is essential to safety" must be observed.

In the use of power tools, such as chain saws, augers and wrenches, the main precaution to be considered is the proper footing of operator while using the tool. Equally important is the proper hold on the tool, for if it should stick or jam while in operation it could either throw the operator off balance or pull from his hands, which could result in a serious injury to the operator or his fellow workmen. Another "must" in the use of power tools is that they should not be left unattended, as they could present stumbling blocks for the workmen, or they could be knocked off and injure a workman. But the most essential things that must be done with any type of machinery are: (1) daily inspections, (2) proper training and experience of operators, and (3) close supervision.

In the construction or maintenance of structures in or near the main line, one thing must be kept in mind at all times and that is the operation of the trains. First, if the track structure is weakened in any way or obstructed so that maximum authorized speed cannot be maintained, flag protection must be provided and slow orders issued when needed. The track itself, if not fully supported, must be well blocked or cribbed to permit the safe passage of the trains. When working on double track, special attention should be given to see that the opposing track is not obstructed, particularly when using a crane which might extend over the track.

When using a locomotive crane or similar on-track equipment, it is thus necessary to flag in both directions and allow a train to pass only on proper signals. At the approach of a train the boom must be in line with the track. All material and equipment must be moved to proper clearance before a train is allowed to pass. In handling material there is always personal danger to the workman in that he may strain his back or permit heavy material to strike or fall on him. In this respect, certain rules of practice should be kept in mind. First, if a crane is available and suited for the job, it should be used, but care should be taken to see that the load is balanced when lifted. For example, when using tongs to lift heavy timber or rail, the tongs should be fastened at the center to acquire a good balance, thus removing the danger of slipping or excessive swinging. If the material is being loaded in cars, care should be taken to see that it does not crush someone against the car and that the workmen's fingers are not caught between the car and the material being loaded. However, if a crane is not available, a sufficient number of men must be present to lift any heavy object.

In loading or unloading heavy equipment from cars the ramp should be well cribbed and the car securely chocked to insure a firm foundation for the machinery. If such work is carried on at a point which could interfere with the trains, flag protection must be provided.

Protecting Safety of Public

In any type of work the safety of the public must be regarded as of first importance. If there is a possibility of objects falling, such as tools or materials, a railing should be constructed around the work at a sufficient distance to protect the public. However, if local conditions exist where there is restricted room, a covered passageway should be constructed. If weather conditions are extreme and ice will form readily, any waste water covering walkways should be covered with salt, sand or ashes to prevent slipping. Tools and material should be placed so that they will not interfere with the workmen or the public, and, at the completion of the day's work, everything should be put away. This is particularly true in regard to ladders providing access to scaffolding in order to prevent trespassers from climbing up on the staging.

Good housekeeping is not only essential for the safety of the public but also equally important for the safety of the workmen. Waste material should be cleaned up and tools kept out of the way or in tool boxes when not required. A large majority of accidents are caused by failure to keep the working area clean from debris, thus creating hazards for the workmen. Fire prevention is likewise important, and gasoline leakage should be

checked regularly. Open flames must be kept away from gasoline storage and engine fuel tanks. Oil on the floors not only creates a fire hazard but will also present the danger of slipping and should be removed or covered with an incombustible or fire-resistant absorbent compound. Likewise, oily rags or waste should be burned or stored so that they will not present a fire hazard.

The problem of proper inspection of equipment before use is very important, but to find the defect is only half of the job. The repair job must be done as soon as the defect is discovered and as quickly as practicable in order that the machine will be out of operation a minimum length of time. Some maintenance jobs can and should be done in the field but only if the correct replacement part is used. Many accidents are the result of makeshift repair jobs. Consequently, if the specified part is not available, operation should stop until proper repair is completed. Certain major repair jobs are only undertaken in maintenance shops. Here a planned program should be set up to progress the repairs to the equipment as fast as possible in order that it may be returned to duty with minimum delay. This is a very important point and cannot be overemphasized, as the promptness of return will not only increase the efficiency of the machine but will also remove any hesitance on the part of the supervisor in shipping defective equipment.

In the shop itself every precaution should be taken to prevent personal injury by using all safety devices at the workman's disposal. Working conditions should be kept constantly in mind. Such important factors as proper lighting, sufficient room and clean surroundings should be available.

Conclusion

The general concept of accident prevention and safety must begin with the management. Each workman should realize that it is the sincere desire of his superiors to prevent accidents, yet he must also realize that unsafe practices are grounds for disciplinary action. The idea of working safely must be emphasized. This is readily accomplished by posters, safety contests and safety meetings. Safety meetings for the workmen are not enough, and the supervisory forces should have separate meetings at regular intervals and be trained in the safe use and technical knowledge of their work equipment. Consequently, through the medium of proper training, close and intelligent supervision, and prompt and accurate maintenance the goal of accident prevention can be achieved.

Foremen and other supervisory officers should never lose sight of the fact that when they were selected for the position they fill, one of the most important qualities they were considered to possess was ability to plan work and supervise workmen with a high degree of safety. Therefore, they owe it to themselves and those who selected them for their position to periodically take inventory to determine if they merit this confidence.

DISCUSSION

J. E. Griffith (Sou.) stated that scaffolding must be built and kept tight and that the scaffolding apparatus should be inspected frequently. He cited an instance where a scaffolding hook broke, resulting in two workmen being dropped into a river. He added that cables do stretch and described how, after a half day's operation following the re-rigging of a locomotive crane, the smaller diameter of the stretched cable allowed it to slip out of the blocks and caused some injuries. G. S. Crites (B.&O., retired) warned that the superelevation of curves must be given careful consideration when operating locomotive cranes on curved track.

Developments in the Use of Laminated Timbers

Report of Committee*

G. W. Benson
Chairman

• Two general types of laminating timber are under test and in use today. These are the glued, laminated members and the bolted connector-type of laminating. There appears in the 1947 proceedings of this association a report on glued, laminated members in bridges. Later information on the installations covered in that report, with data on installations made subsequently, is given in the following.

Test Installations

During October, 1944, the Texas & Pacific installed, as a test of service, 11 glued, laminated 7-in. by 16-in. by 14-ft. stringers in a standard ballasted-deck pile bridge on its main line near Woodlawn, Tex. An inspection of the stringers was made in December 1949 some five years after the installation was made. At that time there were no signs of delamination and the stringers appeared to be in perfect condition.

In 1946 the Southern Pacific constructed a two-panel ballasted-deck pile trestle at Bridge 643.71 near Durnid, Cal., in which 3 laminated caps and 14 laminated stringers were used. The materials used in the caps and stringers was kiln-dried Douglas fir of 2-in. nominal thickness dressed to 1⅝ in. The finished caps were 13½-in. by 14½-in. sections and were built up to 9 horizontal laminations, each lamination consisting of two boards 4⅞ in. and 8⅜ in. wide. The edge joints were pre-glued and staggered in each lamination. The finished stringers were 7¼ in. by 17¾ in. by 30 ft. long, requiring 11 horizontal laminations of the 1⅝-in. thick lumber. Splices in the laminations were made by means of 18-in. scarves. The bridge receives frequent inspection and at last report (summer of 1950) the caps and stringers were performing satisfactorily.

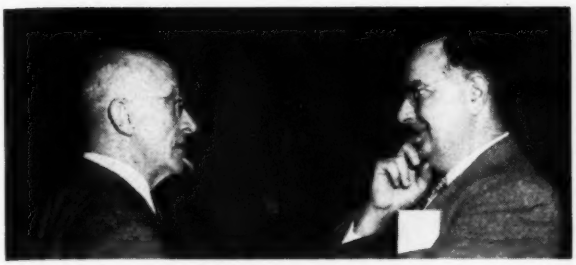
An installation on the Southern near Alexandria, Va., made in October, 1945, consists of 6 stringers, 8 in. by 16 in. by 27 ft.; 4 caps, 12 in. by 14 in. by 13 ft.; and 16 posts, 12 in. by 12 in. by 12 ft. long. An inspection of these timbers made in October 1949 disclosed that, in general, all of them were in excellent condition, with little checking of the timbers or bleeding of the creosote, and only slight openings in the glued joints (similar to small checks) at a few places.

The first installation made on the Chesapeake & Ohio consists of two beams 24 in. by 15 in. by 16 ft. long, laid flat, and installed in a bridge near Newport News, Va., in 1946. These stringers were in good condition in the spring of 1950, with the exception that the top 2-in. by 8-in. member in one of the stringers showed evidence of decay. The defect was noted to a lesser degree when installed and evidently was in the wood when laminated.

The second installation on the C. & O. was made in the latter part of 1946 in Bridge 312 near Ameagle, W. Va. This installation consisted of 8 stringers 7½ in. by 16 in. by 14 ft. long, laminated from 2-in. by 8-in. No. 1 Douglas fir pieces, dressed to 1⅝ in. by 7½ in. The glue used was phenolresorcinol resin glue, and the timbers were treated with a fire-retardant salt by the full-cell process. An inspection of these stringers in the spring of 1950 found them in good condition and with no defects apparent.

Experimental oak ties were installed by the Pennsylvania as a test. These

*Chairman of this committee was G. W. Benson, superintendent bridges, Central of Georgia, Macon, Ga.; vice-chairmen were H. M. Dick, master carpenter, Pennsylvania, Harrisburg, Pa., and J. M. Lowry, bridge engineer and inspector, Texas & New Orleans, Houston, Tex.



R. A. Van Ness, bridge engineer system, A. T. & S. F.; R. Ferguson, electrical engineer, A. A. R.

W. H. Bunge, assistant engineer, M. P.; R. R. Clegg, district sales manager, American Lumber & Treating Co.

were 7-in. by 9-in. members in which the glue lines were vertical. The center laminations in these ties were full length but the outer pieces were applied only under the rail bearing, giving the tie a dumb-bell shape. All were glued. In addition, a portion were fastened with drive screw-dowels, and some with patented fasteners. The ties held with screw dowels were the only ones not showing delamination a year later. Some of the failure of this group of test ties may be attributed to the fact that the design places spike holes in the glue lines, causing the spikes to contribute to the tendency to split.

The Forest Products Laboratory at Madison, Wis., has made extensive investigations of both full-size and test specimens and has published results of experiments in Bulletin No. R1789, "Summary of Information on Gluing of Treated Wood, 1950." This laboratory's extensive investigations are further covered by Bulletins D1635, "Laminating of Structural Wood Products by Gluing;" R1687, "Tests of Glued Laminated Wood Beams and Columns and Developments of Principles of Design;" Technical Bulletin No. 691, "The Glued Laminated Wooden Arch;" and in reprints of A. S. T. M. Bulletin No. 170, "Studies of Strength of Glued Laminated Construction." In addition, the laboratory has compiled a list of nine firms which are equipped to produce structural glued laminated members.

The Forest Products Laboratory of Canada has also conducted extensive investigations, and its results are published in Mimeo 113, "Strength Tests of Glued Laminated Beams;" Mimeo 0-152, "The Construction and Testing of Glued Laminated Arch of 47 ft. Span;" and in a reprint entitled "Radio Frequency Bonding of Laminated Beams."

Among other experiments this laboratory has also done some experimental work on laminated railway ties. Two or three years ago it constructed 32 ties using resorcinol glue and high-frequency curing. The ties were built up of pine and yellow birch. Only the top lamination was of birch, and the purpose of the birch was to increase the resistance of the ties to plate wear. The ties were installed in track of the Canadian Pacific, along with solid control ties, and are being inspected at yearly intervals. The ties were pressure creosoted after gluing and boring for track spikes.

Publications of both of the laboratories mentioned above contain recommended practices and specifications. In addition, the Southern Pine Inspection Bureau has published a pamphlet entitled "Standard Specifications for Structural Glued Laminated Southern Pine."

Use of Bolted Connectors

The bolted-connector type of laminated timber was introduced into the United States from Europe by the National Committee on Wood Utilization and the U. S. Forest Products Laboratory, and has been sponsored by the National Lumber Manufacturers' Association since 1933.

The connectors are of various forms and are placed in the contacting faces of the laminations for the purpose of transferring the load between the members. The connectors are either placed in pre-cut daps or are forced into the timber by pressure. Bolts passing through the timber connectors hold both the connectors and members in place. The Central of Georgia was one of the first railroads to experiment with bolted laminated timbers. In 1942 this company constructed and placed in service 6 test caps, and in September 1949 an additional 25 such caps. The grade of lumber used for the individual pieces, which were 3-in. by 14-in. members, was dense southern yellow pine, which were sized to 2¾ in. by 13¾ in. and bored before treatment.

The laminations in the completed cap are placed edgewise, and selection of this size member gave a completed cap of 13¾ in. by 13¾ in. in section, which is nearly the same as solid 14-in. by 14-in. caps and permits better bolting of sway bracing on to the piles and caps. These are used as needed for repairs on five-pile open-deck trestles on heavy freight and passenger lines. Clamping plate connectors are placed between laminations at the bolt holes. Three different arrangements are under test. A homemade jig with pressure applied by six 35-ton hydraulic jacks was used to press the laminations together, imbedding the teeth of the connectors into the timbers and assuring proper seating of the connector plates.

The Atchison, Topeka & Santa Fe has developed a standard procedure for "Maintenance of Ballasted Deck Trestles." This is based on a complete inspection of each structure to determine what handling is in order for individual panels or the entire bridge. Strengthening of the members to be repaired is done by applying a 3-in. by 8-in. by 14-ft. scab to the bottoms of the stringers, using drivespikes through a connector in a pre-cut dap. The caps have a 4-in. by 12-in. by 14-ft. piece bolted on each side, with connectors in pre-cut daps between the cap and the new scabs. This method is said to be rapid, efficient and economical. It requires only the tools used by ordinary bridge gangs, plus a special tool for making the pre-cut daps for the connectors.

This method can be used to make members of any size. It was used to construct the building having the largest uninterrupted space of any wood building to date, namely, one of about 20 blimp hangars built throughout the country. On the exterior this building is 296.5 ft. wide, more than 170 ft. high, and 1058 ft. long. The uninterrupted clear interior space is 237 ft. wide by 156 ft. high by 1000 ft. long. A 15-story apartment house could be erected beneath its roof. The largest piece of timber used in its great arches is only 6 in. by 14 in. in cross section.

Comparing the Two Methods

It is interesting to compare the two methods of lamination. An elaborate plant must be set up and special equipment used to control conditions of temperature, moisture and pressure of glued members, whereas only a simple inexpensive setup such as that described above is necessary in bolting laminations. Highly trained technical personnel is required in handling glued members. No special training is required in bolting.

No glue has yet been found that is completely satisfactory in adhering to creosoted timber although some success has been attained in gluing woods treated with other preservatives. The preservative has no effect when the laminations are bolted and its uniform distribution throughout the member is assured.

The shrinkage due to drying, or the elongation along the grain of the glued members when wet, is a serious problem, whereas there is no adverse effect from this condition of moisture on bolted members.

Glues must be carefully chosen, which are compatible with the type of wood to be used, but the bolted-connector system works equally well with any type. Smaller members can be made by gluing and these can be efficiently spliced by scarfing to form beams limited in

size only by the ability to apply proper pressure.

The bolted-connector type will in general be found simpler, cheaper, and, of course, is the only type that can be adapted to field erection or repair. The beam produced will be comparatively as effective as the glued member.

Gluing has been attempted only on a semi-commercial or pilot-plant scale in a few instances. This and experimental work with both gluing and the bolted-connector type give no basis for cost comparisons. Either will be considerably higher than a solid member of the same size, and only the results of experiments will tell whether the increased cost is justified.

Glued, laminated members were first used in Europe, particularly in Germany, Sweden and Switzerland nearly 40 years ago. Therefore, they cannot be called an untried form of construction. Their use by railroads, however, is recent and not yet widespread. With the rapid depletion of good timber of sufficient size for our railroad caps and stringers the use of laminated timbers will be accelerated. The scarcity of steel for construction imposed by the rearmament program has greatly accelerated the use of laminated members which are taking the place of steel at places heretofore thought impossible. The War Production Board estimated that in one war year 800 million feet of lumber were saved by timber-connector construction alone.

It seems certain that laminated timbers will play an increasingly important role in the future.

This report is intended to be a brief account of work in this field and is not intended in any way as a specification. The committee is indebted to the Forest Products Laboratories of the United States and Canada, the Southern Pine Inspection Bureau, and a number of manufacturers for information used in making this report.

DISCUSSION

C. A. Moser (Sac. Nor.) stated that he would be interested in inspecting the installations of laminated timbers if there were any test locations not too far from his headquarters at Sacramento. Chairman Benson advised that the one nearest to Sacramento would be at Durnid, Calif., on the Los Angeles division of the Southern Pacific. In response to a question by T. M. Von Sprecken (Sou.) as to the greater cost of laminated timbers as compared with solid timbers, Chairman Benson said it would be approximately 60 per cent more. W. R. Roof (C.G.W., retired) raised the question as to whether the glued laminated timbers were treated in any way, to which Chairman Benson replied that they were not.

Effects of the 40-Hr. Week on Bridge and Building Maintenance

Report of Committee*

• The advent of the 40-hr. basic work week for non-operating railroad employees, which became effective September 1, 1949, was viewed with grave concern by management and supervisory personnel of the American railroads. There was cause for this concern, as no other event since the adoption of the basic 8-hr. work day in 1918, has so vitally affected the maintenance and operation of the railroads. This new agreement reflected a direct loss of 17 per cent in man-hours worked, with no loss in take-home pay for the employees involved.

Since this report will deal only with the effects of the 40-hr. week on bridge and building maintenance, all further statements and references shall be to that effect. Obviously, the report must be of a general nature as these working conditions have been in existence for only two years. For this reason we cannot be too specific in our statements but shall deal rather with those trends and conditions that have developed up to the present time.

The maintenance programs of some railroads were in arrears prior to September 1949, not having fully recovered from the effects of the labor and material shortage during World War II. The additional loss in man-hours has further aggravated this condition to the extent that in some cases it is a serious problem. This is particularly true with reference to steel and masonry repairs and also painting in general. Material shortages may further complicate our repair programs.

F. W. Hutcheson
Chairman

Investigation by questionnaire has brought out that, without exception on the railroads reporting, there was no increase in the number of employees to offset the reduction in man-hours occasioned by the inauguration of the 40-hr. week. In many instances there was an actual reduction in the number of employees to help offset the increase in labor cost. The position of our managements in this respect is readily understood upon an examination of the records throughout the past decade, which shows a continual increase in labor costs, not fully compensated for by increased earnings.

To those of us interested in properly maintaining our territories, these facts are not pleasant, but nevertheless they are real and must be confronted as such. It is again a real challenge to those men on our railroads who have before been confronted with obstacles of varying degree but who have in turn met them with real courage and resourcefulness.

There are a few developments which have contributed towards tempering the shock resulting from these lost man-hours. These developments have occurred on the majority of the railroads that responded to a questionnaire sent out for that purpose. The committee believes that the replies to the questionnaire provide a fair cross-sectional view of the situation on the American railroads with respect to this subject.

Increased Mechanization

The general trend through the past several years has been towards greater mechanization of our bridge and building forces in order to counteract, in some measure, the steadily increasing cost of both labor and materials. This program has been definitely accelerated during 1950 and thus far in 1951, particularly with reference to certain items.

Greater use is now being made of trucks for transporting B.&B. gangs. The increased efficiency resulting from the use of trucks instead of motor cars for transporting men from headquarters to outlying points or from camp cars to jobs on line of road, is conservatively estimated to be from 15 to 18 per cent. Truck transportation provides more on-the-job hours, and is also considered an advantage from the safety standpoint. We realize there are some territories which will not permit the use of motor-truck equipment but these make up only a very small percentage of the over-all picture.

Chairman of this committee was F. W. Hutcheson, supervisor of bridges and buildings, Chesapeake & Ohio, Newport News, Va.; vice-chairmen were I. H. Moore, chief engineer, Chicago & Eastern Illinois, Danville, Ill., and A. Hamill, bridge and building master, Esquimalt & Nanaimo, Victoria, B.C.

F. W. Evinger, Patterson Sargent Co.; C. C. Sims, supervisor bridges and buildings, C. & O.; F. W. Hutcheson, supervisor bridges and buildings, C. & O.

F. N. Beighley, division engineer, St. L.-S. F.; W. A. Scribner, general track foreman, Erie; G. W. Heuss, supervisor bridges and buildings (retired), N Y. C.

It is noted that during the past two years, the purchase of timber saws, impact and power wrenches, and several other items of small tools, has definitely been on the increase. The use of power tools has not yet reached the point of greatest efficiency and we feel that herein lies a fertile field for further study and action. We cannot approach the maximum efficiency of labor until such time as the gangs are fully mechanized. Such a course may be retarded to some extent by the shortage of strategic materials.

It is very important that all tools and equipment be kept in the best possible state of repair. A bridge and building gang may have any number of tools in its tool car but if these tools are not available for use when needed, they are of no value. Most roads have traveling mechanics, in addition to a centralized repair shop, who very often can make the needed repairs and get these tools back in operation without too much lost service time. The supervisor should impress upon each of his foremen the necessity of promptly reporting all breakdowns of all tools and equipment.

Closer Supervision

One result of the 40-hr. week was the necessity for more frequent and closer supervision of the bridge and building gangs. Since there was no additional allowance to make up for the loss in man-hours, it is necessary to obtain more efficient use of the employees' working time. It is also necessary for the supervisor to follow closely the delivery of materials and the movement of the gangs from one point of work to another to minimize delays. All this, of course, requires more frequent and probably longer visits to the job sites by the supervisor.

Many railroads have supplied their supervisors with automobiles, station wagons or pick-up trucks of ½ or ¾ ton capacity for use in covering their territories. The use of trucks is most desirable because it is possible also to take along needed tools or materials from terminal headquarters and to return broken-down tools in need of repairs. Some roads allow their supervisors a mileage rate on the use of their personal automobiles.

General practice on many railroads, prior to the 40-hr. week, was to allow B.&B. gangs to make up time for week-end trips home. This was accomplished in various ways. Some were allowed to work five 10-hr. days and thus go to their homes on Friday night. Others worked 8 hr. on Monday, 9 hr. Tuesday through Friday, and 4 hr. on Saturday. While this practice was a distinct advantage to the employees, it did penalize the railroads in lost efficiency. The 10-hr. day was not good because of the longer hours of being on duty and also because of insufficient daylight to work efficiently and safely during the winter season. The 4-hr. day on Saturday was not good because the ratio of preparation and travel time was entirely too high for the number of on-the-job hours.

Under the 40-hr. week, make-up time has been nearly eliminated. The general work week is Monday through Friday but in a few instances it is Tuesday through Saturday. There are, of course, occasional cases throughout the country which still require a small amount of makeup time in order for the employees to meet train schedules to and from the job site on week ends. However, we can definitely report that make-up time is being held to a minimum consistent with transportation problems.

Many roads have reported that morale is much better among the men due to the longer week end at home. This improvement in morale is reflected in more efficient work during the 40 hr. they are on the job. Some roads also report that there is definitely less absenteeism now than before the 40-hr. week; others can see no difference in this respect.

Much thoughtful consideration has been given to the use of more durable materials, and it is evident that the 40-hr. week has accelerated such programs. Some roads have already adopted, and partially carried out, various phases of replacement programs using materials of a more durable type. Other roads are now making further studies along this line. We believe this field presents great possibilities as the labor cost for applying materials of a durable type is very little higher than for those of a temporary type.

It is not the purpose of this report to go into a detailed discussion of these possibilities but we desire to mention briefly a few of the more important phases relating to the subject.

Considerable stress has been placed on the use of treated timber for B.&B. work during the past several decades. In view of the results obtained from the use of various preservatives, better seasoning conditions, better specifications and closer inspection, we believe there is still room for more emphasis in respect to this matter. The advantages of treated timber in lengthening the maintenance cycle have been proved. Therefore, greater use of these materials will further lengthen this cycle. Over a longer period this will eventually offset a portion of the man-hours lost due to the 40-hr. week.

Some roads are giving preference to the use of pre-fabricated steel buildings as replacements of small roadway and terminal buildings of wood. The first cost is somewhat greater but this cost is more than compensated for in the savings in maintenance through the years following construction. Several other roads indicate that they are giving considerable study to this subject but the scarcity of steel has reduced the availability of material for this type of construction. At the present time no one is able to predict how long this condition may exist.

A continued effort should be made to eliminate bridges and trestles by the use of pipes and culverts where possible. Some of our western roads report savings in the replacement of open-deck timber trestles with ballasted-deck trestles of either treated timber or concrete decks. Others are using concrete piling in lieu of treated timber piling. The longer life expectancy of concrete-pile structures offsets the higher initial cost.

There has been a noticeable trend toward the use of masonry in new construction and also in certain replacements of wooden buildings during the past few years. This applies to both terminal buildings and those along line of road. Use of aluminum or other durable roofs materially reduces maintenance for many years.

These are only a few of the more important phases of bridge and building construction and maintenance whereby savings can be effected by the use of more permanent materials in order to reduce maintenance costs. In view of what has been done, we believe much more can be accomplished along this line by careful study and planning.

Conclusions

It is evident that maintenance budgets will not provide additional allowances to offset the loss in man-hours occasioned by the advent of the 40-hr. basic work

week. There is no indication that any increase can be expected in the immediate future.

In view of this situation there can be but one conclusion. We must do the job with what we have, but in order to do that it must be done more efficiently now than before the 40-hr. week. The committee believes this can be accomplished by giving increased emphasis to the following suggestions:

(1) Increased mechanization of bridge and building gangs with respect to small tools, equipment and transportation facilities. The goal should be set at 100 per cent. In advancing such a program we must not overlook the importance of properly maintaining these tools and equipment so that they are available for use.

(2) Closer supervision of bridge and building gangs to minimize lost time in movements from one project to another, to have the material available for use when needed, and to see that proper use is being made of all types of tools and equipment.

(3) Make further use of more durable materials in both construction and replacements of buildings and structures in order to increase the maintenance cycle.

(4) Exert all influences possible to improve the morale of the employees to obtain more efficient production.

(5) Cooperate with the tool and equipment industry in order that they will continue to build better and more efficient tools and equipment.

DISCUSSION

In reply to a question by Chairman Hutcheson as to whether the 40-hr. week has resulted in excessive overtime work on the part of bridge and building crews, E. H. Barnhart (B.&O.) said that on his division the men are not worked overtime at all except in cases of emergency. Next, L. D. Garis (C.&N.W.) said that, because of the reduction in man-hours occasioned by the inauguration of the 40-hr. week, deferred maintenance was becoming a serious problem, and to overcome it pressure should be put on managements to increase forces when necessary. G. S. Crites (B.&O., retired) stated, however, that he believed the problem would have to be solved by planning, scheduling the work properly, and the application of ingenuity rather than by increasing the payroll. Discussing the problem of deferred maintenance further, Chairman Hutcheson mentioned that, in special cases, management will usually provide additional allowances.

J. M. Gustafson (M.& St.L.), discussing the possibilities of more durable construction to offset the reduction in man-hours resulting from the 40-hr. week, said that in many instances timber bridges could be replaced by culverts. Mr. Crites, however, urged caution in this practice because the reduction in waterway areas might be too great, with the result that washouts might occur in times of exceptional rainfalls.

Fire Protection of Bridges, Trestles and Culverts

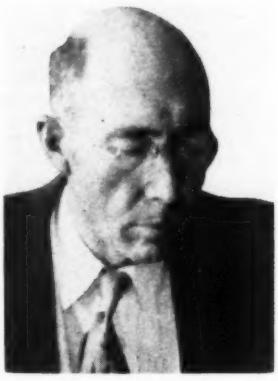
Report of Committee*

• Notwithstanding the progress that has been made in the use of fire-retardant materials and in the various methods devised to protect wood structures from fire, the annual loss and damage to structures on American railroads due to fires from various causes is still a serious matter.

The Association of American Railroads, Fire Protection and Insurance Section, reports that 287 fires occurred in bridges, trestles and culverts during the year 1949, with losses amounting to $595,419. Of this amount 21.4 per cent is classified as caused by locomotives or equipment, 22.9 per cent as resulting from exposure to outside fires, 32.8 per cent from various other sources, and 22.9 per cent from unknown causes. A substantial proportion of this total loss could unquestionably have been eliminated through the increased use of accepted fire-preventive measures in the construction and maintenance of structures. The annual losses would be many times larger were it not for the present widespread use of the various means available for preventing fires. In the previous year the A.A.R. reported 273 fires, with a loss of $883,354.

Maintenance officers of all railroads are seeking new and better methods of combatting and controlling fire in railroad structures to reduce the costly delays to traffic, loss of property, and the possibilities of personal injuries or loss of life.

In order to secure maximum service



T. E. Jackson
Chairman

life, it is the practice on nearly all railroads to treat timber and piling with creosote oil. While creosote-treated timber does present a fire hazard, economic considerations are the predominant factor favoring its use. In this regard a report of a cooperative committee made the following statement in regard to fire prevention many years ago, which remains true today:

"Creosoted material appears to be somewhat more difficult to ignite than untreated material, but once ignited it creates a fire which is hotter and more difficult to control and which is known by experience to be more destructive than fire in untreated material. However, decayed or partially decayed untreated wood is very easily ignited and has caused many fires.

"The likelihood of fire is increased by treatment which results in excessive bleeding of oil, such as might be caused by heavy treatment of green lumber. It should be noted that freshly creosoted material is much more inflammable than that in which the treatment is several months old.

It is urgently recommended that orders for creosoted material be placed as far in advance as possible so the material may season for from three to six months in advance of the construction.

Where it is practicable to do so, freshly treated timber may be rendered more fire resistant by thoroughly coating the upper surface with sand or dry cement. The application should be continued as long as there is any bleeding of oil."

The effort made by railroads in fire protection of open-deck structures is reflected in the following review of various methods that have been adopted, some of which found only scattered favor, and others which found widespread acceptance and continued use.

The earlier means of fire protection were the water barrel and sand box, with necessary pails or shovels, placed at the ends of structures, and at specified intervals on the longer structures. A later practice consisted of providing a solid deck by inserting fillers between the ties, and applying a crushed rock or gravel fire-protective covering. This method was not found satisfactory because the deck timber could not be readily inspected, decay in the then untreated timber was greatly accelerated, and the rock covering would not remain in place.

Galvanized sheet-metal covering placed over the entire top surface of bridge decks came into use. This plan likewise made inspection difficult, and

*Chairman of this committee was T. E. Jackson, general bridge and building supervisor, Southern Pacific, San Francisco, Cal.; vice-chairmen were W. H. Pryor, general foreman bridges and buildings-water service, St. Louis-San Francisco, Memphis, Tenn., and C. V. Lund, assistant engineer, Chicago, Milwaukee, St. Paul & Pacific, Chicago.

also caused trouble with the circuits in signal territory. Recently, aluminum sheet covering has been used on at least one important bridge.

Another standard called for 1-in. treated flooring nailed over treated ties, and a covering of about 2 in. of ballast. This type protection was not satisfactory because of shifting of the ballast. A modification of this plan provided for covering the flooring with asbestos felt, chicken mesh, hot asphalt, and pea gravel; the covering extended over onto the rail flange. This construction gave satisfactory protection, but in time creeping of the rail resulted in the tearing of the covering and in itself became a fire hazard; walkways similarly protected gave satisfactory service. This construction was later revised to separate the rail from the covering by laying strips of sheet metal up over the edge of the rail. This was successful as long as the rail and joints did not creep.

Galvanized sheet metal, placed over the tops of caps and over the tops of stringer chords, was adopted by some railroads at an early date, and this practice remains in favor on many railroads. It is probably the most widely used of all methods for protecting these portions of trestles.

The application of oil paints, mixed with Portland cement and sand, to the tops of ties and stringers is a practice of many years standing.

The use of timber pressure-impregnated with various water-soluble salts having fire-retardant properties has had limited use in bridge structures. In hot, dry locations, timber treated with these salts tends to become brittle, and to check severely, thus increasing the fire hazard. In wet locations, relatively rapid leaching of the salts occurs, reducing or eliminating the protection.

Fire-Detection Systems

Some installations of fire detection systems have been made to long and important bridges. These consist essentially of insulated wire with fusible links laid across the structure in the most advantageous manner, connected to the signal circuit. In case of fire, the fusible inks burn out and cause the signals to be placed at "stop," and may also be wired to give an indication or alarm to the dispatcher. One modification made of this type of protection for very important bridges provides a water supply and dry-pipe water line laid on the deck of the structure, with necessary piping to sprinkler heads, in addition to the fusible-link detection system. The dispatcher, on receipt of an indication, may turn on the water by remote control, or it may be made automatic.

The most recent method of protecting open-deck bridges and trestles against deck fires consists of applying bituminous coatings over the tops of the ties, stringers, guardrail and walk plank, and into which pea gravel is embedded. The results have been very encouraging thus far in those territories where it has been extensively used. A detailed description of this method is contained in a previous report to this Association and printed in the 1949 Proceedings.

Foot walks of steel checkered plates and steel handrails offer substantially complete protection on large open-deck bridges and reduce the inflammable material on structures of this class.

The use of fire breaks in the longer timber trestles has been accepted as good practice for many years. These may be constructed of concrete masonry, or by sheathing pile or timber bents with cement-asbestos board, or other noncombustible or slow-burning construction.

One railroad is planning to encase, to necessary height, the individual piles in some bents of certain important trestles with a covering of mesh-reinforced concrete, as protection against ground fires, and is also considering the use of asbestos-cement board applied to the exposed portions of the caps at end bents, to bulkhead timbers, and to the undersides of stringers in the end spans, because of the prevalence of fires at or near the ends of structures.

With regard to timber culverts, greatest emphasis is placed on keeping such structures free from combustible material, and keeping vegetation and brush cut at the ends of the culverts. Timber culverts on most railroads have been gradually replaced by concrete or corrugated metal pipe.

Ballast-Deck Structures

Ballast-deck structures offer substantially complete protection against fires which originate on the deck, and it is also current practice on some railroads to cover the ballast-retaining timber with galvanized iron. The use of fire breaks in long ballast-deck trestles is about as common as in open-deck structures.

As with open-deck trestles, the extreme importance of keeping the area around and under structures cleared of brush and vegetation growths, debris and drift, needs continued emphasis. The use of chemicals to sterilize the ground and prevent weed growth is currently receiving much attention and their use for this purpose is rapidly increasing.

Making Wood Fire Retardant

The present state of progress in protecting wood structures against loss by fire is reviewed in an authoritative paper by the Forest Products Laboratory of the U.S. Department of Agriculture entitled "Making Wood Fire Retardant," published in March, 1950. The following is extracted from that publication:

"In discussing fire-retardant treatments for wood it should be kept in mind that there are two distinct aspects of fire performance. One is fire spread, and relates to the rapidity or freedom with which fire spreads over a surface that has been ignited. The other may be termed fire resistance and relates to the tendency of fire to penetrate a member or structure. The manner and extent to which the spread of fire is retarded and in which penetration of fire is resisted are often closely related.

"Wood chars when exposed to fire or fire temperatures, irrespective of whether it has had a fire-retardant treatment or application. The rate of charring or destruction and the transmission of heat through wood may be improved slightly by fire-retardant treatments but the most significant benefit comes in reducing or delaying the spread of fire. Fire-retardant treatments and applications can only be expected to retard the burning and spread of fire to the point where the wood will not continue to burn when the ignition source is removed or exhausted.

"Two general methods are available for improving the performance of wood under fire conditions. One method consists of an impregnation treatment that deposits chemicals within the wood. The other is the application of coatings or layers of other noncombustible materials over the surface of the wood.

"Many water-soluble chemicals exhibit fire-retarding properties when present in wood but because of cost limitations or various objectionable characteristics, comparatively few are considered practical. Among the most commonly used chemicals are monobasic and dibasic ammonium phosphates, ammonium sulphate, borax, boric acid and zinc chloride. These are usually combined in various proportions in wood-treating formulas.

"Since the fire-retardant chemicals are water soluble and hence more or less leachable, the usefulness of treated material under exterior exposure and periodically wet conditions has not been well established.

"Many coating materials provide fire-retarding effects in varying degree to wood. As in the case of impregnation treatments the degree of protection provided by coatings is related to the inherent properties of the product, the amount and thoroughness of application, and the severity of the fire exposure."

Conclusions

The committee is of the opinion that the following practices, most of which are well established, hold the greatest promise of reducing fire losses:

(1) Ballast-deck construction should be used in preference to open-deck, where experience in the particular locality indicates the hazard from hot cinders, burning oil, hot brake shoe metal, fusees, etc., is serious.

(2) Timber trestles of considerable length should have fire breaks at intervals, constructed of concrete masonry piers or bents, cement-asbestos board sheathing applied to the pile bents, or other non-inflammable construction. Such barriers should be continued up between the stringers and ties.

(3) Timber used in bridge and trestle construction, when treated with creosote, should preferably be stored for several months before installation, to minimize the fire hazard of freshly creosoted timber.

(4) In those territories where deck fires are frequently experienced, careful consideration should be given to covering the vulnerable surfaces of ties,

Past-presidents at special session commemorating the association's sixtieth anniversary. They are (back row): J. S. Hancock, bridge engineer, D. T. & I. (president 1947-1948); N. D. Howard, secretary, A. R. E. A. (1945-1946); E. H. Barnhart, division engineer, B. & O. (1948-1949); R. E. Dove, associate editor, R. E. & M. (1941-1942); W. A. Huckstep, general supervisor of buildings, M. P. (1950-1951). Front row: W. F. Martens, general foreman bridges and buildings, A. T. & S. F. (1949-1950); L. D. Hadwen, engineer masonry construction (retired), C. M. St. P. & P. (1914-1915); A. E. Bechtelheimer, engineer of bridges (retired), C. & N. W. (1939-1940); T. H. Strate, division engineer (retired), C. M. St. P. & P. (1935-1936); G. S. Crites, division engineer, (retired), B. & O. (1942-1943)

stringers, guard timbers and walk plank of open-deck bridges and trestles with coatings which have demonstrated their effectiveness and durability under the climatic conditions to which they are subjected in service.

(5) The use of sheet-metal coverings over the tops of caps and stringers is a time-tested and proven practice on many railroads, and merits continued use.

(6) Particularly important bridges may warrant the use of special fire-protection installations, such as fusible-link fire-alarm systems and dry-pipe sprinkler system. Also, the use of checkered plate foot-walk materials and steel handrails should be considered on large bridges in the interest of reducing the amount of inflammable material construction.

(7) Increased consideration should be given to providing fire-extinguishers at important structures.

(8) The actual availability and effectiveness of water or sand from water barrels or sand boxes should be given greater consideration in evaluating comparative merits of these long-established practices as compared to other methods of fire protection.

(9) Such well-established and extremely important practices as the removal of drift and debris from under structures, the removal of punk wood, refuse, etc., and the clearing of vegetation from under and around structures are essential to fire prevention.

(10) The effectiveness of chemicals, to sterilize the soil and retard or prevent the growth of vegetation has already been demonstrated, and its economy in many territories as compared to hand scalping or cutting of weeds and brush has been established. Increased attention should be given this method.

DISCUSSION

In the committee chairman's absence, Vice-chairman W. H. Pryor (St.L-S.F.) read the report. The discussion was begun by J. J. Healy (B.&M.) who referred to that portion of the report dealing with coating the bridge decks with a bituminous material and gravel, and stated that he had difficulty in applying this coating to the sides of the bridge ties. He tried building a form for this purpose which slowed down the work and made it an expensive undertaking. Hence, he doubted the economy of carrying the coating down the sides of the ties.

Lee Mayfield (M.P.) stated that he had carried this work out on three bridges, one 800 ft., another 1,000 ft. and the third 1,500 ft. long, and that he had coated the sides of the ties by holding short boards at the sides while the bituminous material and pea gravel were being applied. The cost for this work, using a small hand pump for the bituminous application, ran around $.80 a sq. ft., he said, and after three years of service, the coatings are still in good condition.

F. M. Misch (S.P.) said that his road has used this same process on about 80 miles of timber bridge decks with good results, but the coating, except what might spill over, is confined to the top surfaces of ties, stringers and guard timbers. He added that they use small, easily-installed-and-removed forms for holding the gravel in place overnight, by which time the coating is well set. Mr. Mayfield said that the surface on which the coatings are applied must be absolutely dry at the time of application, and that failure to obtain a good bond can often be attributed to applying the coating after a rain or even during foggy weather.

G. S. Crites (B.&O., retired) stated that he had noted some instances on eastern railroads where cinders were placed on the ground around piles and also used as backfill at bulkheads. He warned that ground fires will sometimes ignite cinders and, when used around bridges, can cause long-smoldering fires that would endanger the structures.

To a question raised by E. L. Collette (St.L-S.F.) as to a comparison of the hazard of fires instigated through the operation of diesel and steam locomotives, Vice-Chairman Pryor replied that he had no such figures, but that he knew that fires starting from dropped hot cinders were far less in number than those originating from chips off of hot brake shoes. He added that replies from committee members indicated that fire-protection methods for bridges and trestles were the same over the country. His road, he continued, used chemicals to destroy weeds under bridges which was far cheaper than hand scalping with the present labor rates. In addition, the chemicals have the advantage of killing the weeds for at least one year, whereas hand scalping had to be repeated in a few weeks after the first operation.

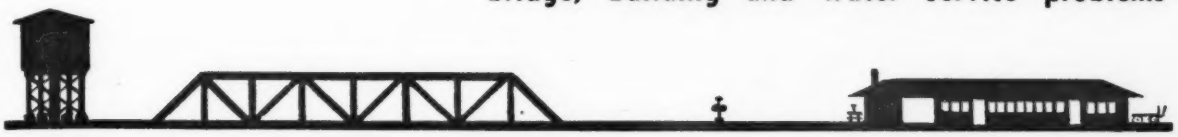
Mr. Crites said that he took exception to the general belief that large numbers of fires are started by hot cinders dropped by steam locomotives, and that he likewise believed that few fires started from pieces of hot brake shoes. To this, J. F. Warrenfells (S.A.L.) stated that he had seven fires originating from pieces of hot metal dropping from brake shoes on old cypress bridges ties.

L. B. Mohney (Pitts & Shaw.) asked why one of the more recently introduced tie protective coatings did not require a gravel sprinkling. Several nembers present stated that they had made use of the newer coating without gravel but that the applications had been made only from three weeks to two months ago and that it was still too soon to draw any conclusions. In this connection, L. R. Morgan (N.Y.C.) said that the Fire Protection & Insurance Section of the A.A.R. is preparing a report on the comparative values of various coatings and that this report should be available in a few months.

Vice-Chairman Pryor referred to the insulated wire with fusible links mentioned in the committee report and stated that the signal men on his road were opposed to their use because of fuse failure would sometimes effect the operation of the signals. But H. R. Demmon (S.P.) said that the links are used on his road and he cannot recall of a single instance where any failure of the links caused the signals to show Stop indications unnecessarily. Mr. Misch said that he did know of a few instances where vibration caused a few of the links to break, resulting in some unnecessary stop signal indications. On the other hand, he added, the links have called attention to fires which, if they had gotten out of control, would have caused far more serious damage than a few unnecessary stops of trains.

WHAT'S THE ANSWER?

An open forum for maintenance men on track, bridge, building and water service problems



Cold-Weather Starting of Diesel Engines

What are some of the best ways of facilitating the starting of diesel engines on tractors and other roadway machines in extremely cold weather? What other aids are available for this purpose? Explain.

Use Air Heaters or Primers

By J. M. Bratcher
Sales Promotion, Tractor Division, Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

When starting an internal combustion engine in cold weather, a large part of the energy of combustion is absorbed by the pistons, cylinder walls and cooling water, and in overcoming friction.

Under extremely low outside temperatures, the cold oil in the bearings and between the pistons and cylinder walls creates very high friction and the effort to crank the engine is much greater than when the engine is warm. In the diesel engine, the only means of igniting the fuel sprayed into the combustion chamber is the increased temperature due to compressing the air. This temperature becomes high enough under ordinary operating conditions, but may not be sufficiently high at extremely low outside temperatures to ignite the charge. Under these unusually cold conditions, therefore, some external means of warming the ingoing air may be necessary.

Our early-model motor graders and tractors are equipped with an engine air heater. The air heater is used to pre-heat the air delivered by the engine blower to the engine as it passes through the engine air box into the cylinders. A sufficiently high temperature for ignition is thus attained.

Later-model motor graders and tractors are equipped with a primer which is used as an aid in starting the engine. The primer is used to force highly combustible starting fluid through a vaporizing nozzle into the engine air intake tube. The vaporized fluid is then picked up by the engine blower and blown into the cylinders. Since the starting fluid is highly combustible, it is easily ignited by compression in the cylinders. The engine will start quickly at low ambient temperatures with the aid of the primer, if the starter will crank the engine even at a very low cranking speed.

The starting fluid contained in the capsule is essentially ethyl ether, which is highly inflammable, and should be treated with the same caution as high-octane gasoline. Gelatine capsules dissolve in water and soften at high temperatures. Therefore, it is best to avoid: (1) breathing large quantities of the fumes from starting fluid; (2) cutting hands on barbs of puncturing plunger; (3) proximity of fluid and capsules to open flames, sparks or hot surfaces; (4) contact of capsules with water; and (5) subjection of capsules to high temperatures (above about 120 deg.. F.).

More detailed descriptions of the engine air heater and starting-fluid primer as well as comprehensive instructions in their operation and maintenance are given in Form TM-1A which covers the entire subject of "Cold Weather Starting and Operating Diesel-Powered Motor Graders and Tractors." This pamphlet is available to all our tractor users.

Use Starting-Fluid Capsules

By J. A. Jones, Jr.
Manager Sales—Special Products, The California Oil Company, New York

The starting of diesel engines at low ambient temperatures is most easily accomplished by the in-

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Answers to the following questions are solicited from readers. They should be addressed to the What's the Answer editor, *Railway Engineering and Maintenance*, 79 W. Monroe St., Chicago 3, and reach him at least 30 days in advance of the issue in which they are to appear. An honorarium will be given for each published answer on the basis of its substance and length. Answers will appear with or without the name and title of the author, as may be requested. The editor will also welcome any questions which you may wish to have discussed.

To be Answered In the January Issue

1. What is the best way to protect rail-head bonds from the excessive heat of rail-end-welding or heat-treating operations? Why is protection necessary? Explain.

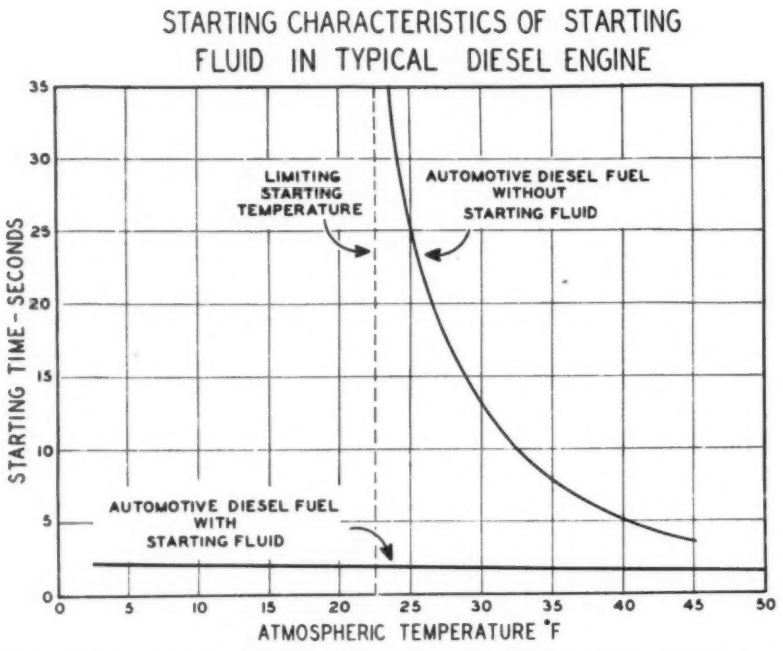
2. In view of present high labor costs is the application of quality paints made by reputable manufacturers more economical over the long term than the use of lower-priced paints mixed according to specifications of individual roads?

3. How should the repair of auto trucks assigned to m/w use be planned and executed? Where should this work be done? Explain.

4. How do the new-type reinforcing bars recently approved by the American Concrete Institute differ from other reinforcing bars? What are the advantages to be derived from using bars of the new type? Explain.

5. What effect does foreign matter in the fuel have on the performance of roadway machines powered with diesel or gasoline engines? To what extent can filters be used to assure cleanliness? Explain.

6. When establishing new diesel fuel-oil storage facilities or enlarging existing facilities, what type and capacity of tanks should be used? What precautions should be taken in their construction? Explain.



As shown by this chart, diesel engines can be started in less than five minutes at temperatures as low as zero degrees F., if starting fluid is used

jection of a starting fluid into the intake air manifold at the time of starting.

During the early part of World War II large-scale operations in Arctic regions were seriously handicapped by the difficulties encountered in the cold starting of internal combustion engines. This made the solution of these problems mandatory. Extensive research programs were conducted in this country and in Europe towards that end. Consequently, as early as 1941, data had been obtained which showed that, when certain compounds were injected into the intake air manifolds of an internal combustion engine, this cold starting problem was alleviated. Laboratory and field investigation on the efficacy of various ethers, volatile hydrocarbons and other organic substances as ignition promoters were conducted by The Standard Oil Company of California and the results confirmed earlier findings. This work led to the development, in 1942, of an ether-base starting aid.

This fluid was first given field tests on the Alcan highway, during its construction in the winter of 1942 and 1943, in both diesel and gasoline powered equipment. Prior to the use of this starting fluid, it was general practice in that area to idle engines continuously when not in use, or, if it were necessary to stop the engines, external heat had to be applied, or towing the vehicles was necessary to achieve starting. These last methods were both time consuming and expensive, and many vehicles were lost because of fires resulting from preheating. In these field tests it was found that starting of the engines could be achieved at temperatures of —50 deg. F. in 10 sec. or less when several milliliters of the starting fluid was injected into the intake air stream.

More recently, further testing of the product was conducted at the U. S. Army Engineers' Research and Development Laboratories at Fort Belvoir, Va., and at the U. S. Navy Engineering Experiment Station, Annapolis, Md. These tests further demonstrated the efficacy of this product as a cold starting aid for diesel engines. Subsequent civilian use of the starting fluid has shown a wide field of application to exist in the starting of diesel engines in poor mechanical condition, at temperatures as high as 40 deg. F., and at high altitudes. The effectiveness of the starting fluid in this service is illustrated in an accompanying chart which shows the limiting starting temperature for a popular make of diesel engine when automotive diesel fuel is used: (1) alone; and (2) in connection with a starting fluid.

The success of the starting fluid is due principally to its low ignition temperature, wherein it starts to burn at substantially lower temperatures than conventional fuels; secondly to its seven-fold wider range of inflammability than gasoline or diesel fuel; and thirdly to its high volatility which permits fluid vaporization more rapidly and completely than gasoline or diesel fuel at low temperatures.

This starting fluid combines several ingredients to provide top-cylinder lubrication and to eliminate storage stability problems. It likewise minimizes: (1) starting period; (2) wear; (3) cranking torque; (4) depletion of battery or compressed air; (5) dilution of lubricating oil by fuel; (6) expense; and (7) inconvenience.

The widespread use of this starting fluid in all types of automotive and diesel service has resulted in major improvements in packing it and in the methods of injecting the fluid into an engine. Originally it was only available in metal containers, and a hand spray gun was used to introduce the fluid into the manifold. The spray gun gave way to an auxiliary tank, permanently mounted to the vehicle. Fluid was poured into the auxiliary tank and fed to the engine's manifold by a priming pump controlled by the operator. Although both of these methods—the hand spray gun and the auxiliary-tank priming pump—were successfully used to achieve starting under severe cold operating conditions, the disadvantages and the hazards of these methods were soon realized. To overcome these hazards we developed in 1948 the capsule method for packing and appying the starting fluid. This method is the safest and the most inexpensive way to apply starting fluid, and has removed, to a maximum degree, the hazards and the expense of applying a starting fluid.

In this method gelatin capsules in two sizes containing either 7 cc. or 17 cc. of starting fluid are packed in tight, metal cans. The capsule sizes have been designed to provide the correct quantity of fluid which experience has shown is required to start most engines. The capsules are used with a special puncturing tool and priming system permanently connected to the intake manifold system of the engine. One or more capsules are placed in the puncturing tool where the fluid, in a pre-determined amount, is then released to the primer pump for priming into the engine by the operator. The advantages of this system over the auxiliary-tank and spray-gun systems are: (1) correct quantity of fluid is pre-determined and measur-

ed; (2) little chance of over-priming or flooding engine with excessive amounts which could cause damage to engine parts; (3) spillage when pouring from cans, and evaporation losses, are avoided; and (4) capsules are packed in metal containers and stored safely and easily at normal temperatures.

Use Many "Tricks of Trade"

By S. H. Knight

Supervisor Work Equipment, Northern Pacific, St. Paul, Minn.

Cold-weather starting of diesel engines in any use in which they are unprotected overnight or over the week end is a problem and can be very troublesome when temperatures range below zero. It is to be assumed that fuel of the correct specific gravity, viscosity, and flow point for the temperatures involved has been provided, and that the question applies only to normal starting difficulties caused by piston and bearing drag, lowered battery efficiency, etc. The subject is, I believe, receiving much study on the part of the military forces.

Synthetic oils are available which reduce friction and drag but which are not yet practicable for general usage. For cold-weather starting of open, diesel-powered tractors and other roadway equipment it is imperative that the proper winter grade of lubricants are used and that the storage batteries are charged. On larger equipment where heavy batteries are involved that cannot be readily removed for overnight storage, a booster battery will help. Ether starting fluid is used and in capsule form is considered safe. On a diesel engine equipped with an auxiliary, gasoline-powered, starting engine the problem is not so serious, but here, too, main-engine crankcase lubrication should be watched carefully. We also use blow torches on the intake manifold to pre-heat the air.

For cab-type machines, such as crawler-mounted shovels, draglines and rail cranes, the best cold-weather starting aid is a small, coal burning, water-jacketed heater connected into the main-engine cooling system or a liquid-fuel burning coil-type heater similarly connected. With such heaters we can raise the main-engine jacket temperatures to 140 deg. F. in 30 min.

Somewhere it has been stated that one sub-zero start on a diesel engine can result in the equivalent wear and tear of 250 hr. of summer operation. Whether that is so or not, much closer attention to maintenance of fuel pumps, injectors, thermostats, radiator protection, canvas hood covers, lubrication and electrical accessories is not only desirable but essential.

Mobile Equipment for Refueling Diesels

Under what conditions is it desirable to use mobile equipment for fueling and sanding diesel locomotives? What general characteristics should be possessed by such servicing units?

Use Cab-Over-Engine Trucks

By Engineer of Fuel and Water Service

Mobile equipment is most effective in fueling and sanding diesel switching locomotives stationed at outlying points. However, such equipment once firmly established for that purpose, has been found very helpful for servicing road locomotives in emergencies.

The basic characteristics that mobile servicing units must possess consist of maneuverability, adequate capacity and proper weight distribution to conform to state axle-load limits.

The first of these requirements, maneuverability, is nicely provided by a short wheel-base, cab-over-engine tank truck similar to those used for the delivery of household fuel oil. Trucks of this type also provide ample capacity—up to 1500 gal. of oil and one ton of sand—to service at least two switchers. Oil is pumped from the truck by a power take-off from the truck engine. Lubricants can be stocked in cabinets along the side of the truck.

Sand is usually stored in a pressurized conical hopper from which it is pneumatically fed into the sand box of a locomotive by an air jet at the point of discharge. The air for this operation is obtained from the brake pipe of the locomotive. With such mobile fueling units, switching locomotives can be serviced at the rate of 50 gal. of fuel oil and 100 lb. of sand per minute.

House Trailers for B&B Employees

To what extent are automotive house trailers adaptable to use by bridge and building forces in place of camp cars? What are their advantages, if any, for this purpose?

Trailers Not "Cure-Alls"

By General Bridge & Building Supervisor

Probably the best arrangement of B & B gangs will always be by districts having a headquarters for each gang in a convenient small town. This would be convenient for the men who could then have their families with them. To suit their own tastes, the men could either rent, own their own homes, or use automobile trailers.

Under such an arrangement, regular work could be carried out within a radius of 35 to 40 miles from headquarters by using truck transportation. Emergency work farther than 40 miles from headquarters could be handled in a similar manner. However, if regular work was necessary beyond the 40-mile limit, it could best be taken care of by a gang headquartered closer to it or by a gang stationed in camp cars—for experience has shown that 40 miles is the economic limit for truck transportation.

Automotive house trailers, as they are now built, do not appear to lend themselves to the housing of our gangs, particularly the larger ones. Such trailers have a definite use by individual employees with small families and private automobiles for moving the trailers

from place to place. However, the problem of transporting the large numbers of trailers that would be required for a big gang constitutes the major deterrent to their use in our work. In their stead, portable houses would seem to be more adaptable to our particular class of service.

On the other hand, for special services, like welders, flame cleaners, painters and other small, independent units, specially designed automotive trailers would seem to be "good bets."

Wood Freighthouse Floors for Lift Trucks

How can wood freighthouse floors be economically adapted to give satisfactory service where lift trucks and other wheel-mounted equipment have been introduced? Explain.

Suit Floor to Wheel Loads

By B. M. Murdoch
Engineer of Buildings,
Illinois Central, Chicago

In considering this problem, it will be necessary first to ascertain the loads which will be imposed by the newly introduced freight-handling equipment. This is very important, first, because some lift trucks produce very large concentrated loads, especially under the front wheels; and, second, because very few freighthouses, especially of the older construction having wood floors, are constructed sufficiently strong to support heavy concentrated loads.

In many instances, it will be found necessary to replace the frame construction with a floor placed on fill. In such instances, it may be found advisable to use a different type of floor surfacing. Where the sub-floor construction is found to be strong enough safely to support the newly imposed loading, and where the existing flooring is not edge-grain material or made of some hard wood such as oak or maple, it may be found advisable to apply a top flooring of one of these materials. Steel plates or some other type of metal floor surfacing material may be used to prolong the life of the wood floor, especially where heavy wear occurs. There are also different forms of mastic materials that may be used as top coatings for old, but strong, wood floors to make them more serviceable.

An inspection should be made to determine if the new top flooring should be applied at once or if the existing floor surface will be suitable for use over some period of time previous to the application of the new top surface.

In making studies as to the advisability and economy to be derived from the use of lift trucks and other wheel-mounted equipment, careful consideration should be given to the problem of what changes will be necessary to the existing floor construction.

Special Cars Vs. Hoppers for Ballast

What are the advantages and disadvantages of designing ballast cars as multiple-purpose units, suitable for revenue service as well as m/w use? Explain.

Hard to Get Cars "Home"

By G. A. Phillips
Chief Engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

This railroad has a considerable number of ballast cars of the multiple-purpose type by means of which the ballast can be distributed between the rails and/or along the ends of the ties. A large portion of our work requires this latter method of distribution. "Outside" dumping in that manner can be done with greater speed with special ballast cars than with the conventional type of hopper car, even with the help on the latter of ballast pans which requires considerable time to attach.

In this part of the country the work is seasonal and, after ballasting has stopped, multiple-purpose cars can be placed in revenue service the balance of the year unless they are in the shop for repairs. The greatest disadvantage of using multiple-purpose units in this way is the problem of getting the cars returned in good condition to the owning road before the beginning of the working season.

Keep on Own Lines

By J. E. Fanning
Assistant to Chief Engineer,
Illinois Central, Chicago

Maintenance of way officers realize the value of keeping work equipment busy. This offers no problem as far as ballast cars are concerned, provided they are so designed as to be suitable for transportation and distribution of ballast during the work season and for use in revenue service during the remaining time.

In earlier days, when many railroads operated their own ballast pits, it was the practice to store ballast cars in the pits during the "off season." In many instances, they were stored on side tracks. The result was rapid deterioration of the cars and much extra switching. Now that most railroads purchase their ballast supply from commercial firms, it is even more desirable that ballast cars be so designed that they may be used in both classes of service. Finding tracks on which to store idle ballast cars would present a real problem on a busy railroad.

The number of multiple-purpose cars designed and built, or acquired, should be based on the ballast requirements, since such cars are usually more expensive than those designed for a single purpose.

They should, of course, be removed from service long enough to make such repairs as may be needed to place them in good order. Unless doors and latches work properly, extra work-train expense will be incurred and many man-hours will be lost in the distribution of ballast.

One of the disadvantages of using ballast cars in revenue service is the time and the "light" mileage required to assemble them at the beginning of the working season. The probability of delay to ballasting operations, due to car shortage, may be minimized by

(*Continued on page* 1040)

"IT HAS TAKEN US A PERIOD OF YEARS TO EVALUATE WEED KILLING SERVICE BUT ONE APPLICATION OF BRUSH KILLING CHEMICAL SERVED TO SELL US. WE ARE NOW DEFINITELY CHEMICAL MINDED. NEXT YEAR OUR CONTRACT WITH YOUR COMPANY WILL CALL FOR TREATING A BROADER AREA OF RIGHT OF WAY, UTILIZING BOTH WEED AND BRUSH KILLER."

This crisp statement coming from the officer who holds the purse strings for a large system left little to be added. Here was a system that had spent money year after year in an effort to control undesirable growth in country where growth is rank and persistent. A figure minded VP had watched the work in a spirit of "SHOW ME."

This is typical of the progress that has made us a leader in our field. Research carried on without interruption for many years has added to our fund of information on this important problem that all railroads face each growing season.

Perhaps we can suggest a program of weed or brush control for your study, looking toward this type of work in 1952.

READE EST 1883

READE TRACK ALIGNER

SAVES UP TO 50% IN TIME AND LABOR

This modern tool, the READE TRACK ALIGNER, takes the place of *eight men* using old-fashioned lining bars on track. Two men, each operating a READE TRACK ALIGNER, spaced a half rail length apart, can do an easier, better, safer job than a gang of ten men using bars and brute force. The tool does the heavy work, and minimizes chances of strains and personal injury to the workers.

Furthermore no digging of tie ends is necessary with the READE TRACK ALIGNER, and track is shifted without humping or raising out of cross level.

Write for full details on this new tool, and let us demonstrate its advantages on your own track.

READE TRACK ALIGNER in working position, with holding fin inserted in ballast between ties, and jacking rack against base of rail; carrying handle is at front of jack.

After lining has been completed, lining bar has been removed from position in socket and carrying handle thrown to rear of jack.

With lining bar replaced in socket, operator pulls back on it to take strain off holding pawl; at the same time he steps on carrying handle to trip jack and release pressure on rail.

Jacking rack has returned to original position by spring action, and track aligner can now be picked up and moved to next location.

READE MANUFACTURING CO., INC.

Plants in numerous railroad centers

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Service Headquarters
9500 Cottage Grove Avenue
Chicago 28, Illinois

ordering the return of the cars to assembly points several weeks before the start of ballasting operations and by restricting their revenue service to the lines of the owning Railroad.

Dual-Purpose Cars Best

By J. G. Gilley
Engineer of Track, Chesapeake & Ohio, Richmond, Va.

The prime advantage in designing ballast cars as multiple-purpose units, or at least as dual-purpose cars, is that such units aid in producing revenue during the off season when track-ballasting operations are suspended.

The advantage of such cars in handling ballast in track-maintenance work is unquestioned. Because they require no chains, pans, boards or other impediments as do other types of cars, they thus produce savings in labor and work-train expense. A prerequisite to economy in maintenance work, however, is that such cars must be maintained in a workable condition.

The extent of the saving effected by using these cars in ballasting track raised three inches, instead of using standard hopper cars, was determined by a test on one railroad. Carefully kept records indicated that it required more labor per mile of track to unload ballast from hopper cars than from multiple-purpose cars.

The records also showed that the dressing of ballast unloaded from hopper cars required considerably more labor per mile of track than was needed when it was unloaded from multiple-purpose cars. In fact, the savings thus realized amounted to several hundred dollars per track-mile, exclusive of work trains.

The test also developed that the finer adjustments to which multiple-purpose cars lend themselves resulted in the ballast unloaded from them covering as much as 0.02 mile per car more than that unloaded from hopper cars. Where work trains are not permitted to remain overnight at outlying or intermediate points, but must be run into terminals each day, the economy of using multiple-purpose ballast cars is further increased.

There are instances of favorable locations of quarries and mines, for example, with relation to each other, where the cross-haul movement is very advantageous. That is, multiple-purpose cars can be loaded at the ballast quarry and unloaded in the vicinity of mines, from which the cars may return under revenue load to the vicinity of the quarry.

On the other hand, there are two principal disadvantages in the use of multiple-purpose ballast cars. (1) It is claimed that the cost of maintaining such cars exceeds that of hopper cars, and that in making programmed repairs the "more complex" mechanism of doors hinged longitudinally rather than crosswise requires more shop man-hours per car than hoppers do; (2) as units for revenue service, multiple-purpose cars seem generally to be of lower cubic capacity than hopper cars.

We are convinced, however, that these disadvantages are far outweighed by the advantages and that the use of multiple-purpose cars, in good operating condition, results in considerable savings.

T-Rail or Girder Rail on Piers?

Where fork-lift trucks and similar types of freight-handling equipment must be operated over tracks in paved surfaces, such as on piers, what are the relative advantages of T-rail and girder-rail construction? Explain.

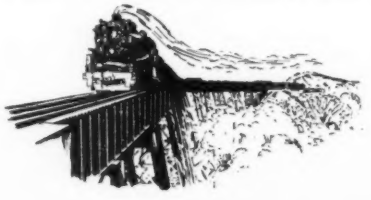
T-Rails Are Better

By Track Supervisor

During the last decade there has been a definite trend away from the use of girder rail sections in the paved areas of streets, with a consequent reduction of inventory of such rail and its fittings. Cognizance of this trend was taken by the American Railway Engineering Association as long ago as 1946. In that year the Rail committee reported; "Because there is a limited demand for girder rails for (steam) railroad use, and also because both the specifications and designs are readily available in pamphlet form through the American Transit Engineering Association for those desiring this information, it is recommended that the specifications For Open-Hearth Steel Girder Rails of Plain, Grooved, and Guard Types, and the Rail Sections be eliminated from the Manual."

For that reason, more than any other, I would hesitate to recommend the use of girder rail on piers regardless of the views of some of its proponents who make superficial claims of its benefits where lift trucks and other mechanical handling equipment is in use. In fact I take exception to claims that lift trucks will operate over girder-rail track more smoothly than over T-rails.

On piers, the running rails are almost invariably wet, a condition that's conducive to the slipping of rubber-tired wheels of mechanical equipment. Furthermore, the flangeway on girder rails is about 3 in. wide and 1¾ in. deep with



metal in contact with wheels at both points. Small-diameter wheels such as those on most lift trucks will drop into such a depression with a considerable jar.

With T-rail track, the flangeway can be made no deeper than the depth of an M.C.B. flange (⅞ in. max.) and only slightly wider. This is true, of course, only for asphaltic-type flooring, but other types can be constructed that will approach this minimum. Such small depressions offer little resistance to the movement of mechanical equipment and cause only slight jars. These opinions presuppose that flangeways are not constructed with guard rails like those used on highway crossings, but are cut into the new, raw flooring by wheel flanges or made in some other manner to simulate flange cuts. In doing this, one precaution is essential—that the flangeway is made deep enough to prevent the weight of cars and locomotives from being carried on wheel flanges on the floor rather than on wheel treads on the rails.

Another disadvantage, in some cases, of girder rails is their greater height. In some types of floor construction this imposes added problems of construction and increases costs.

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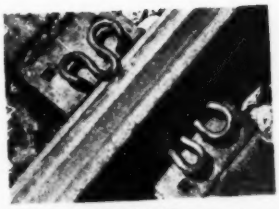

DRIVES INTO TIE through line spike holes of standard tie plate. No maintenance . . . because it won't work out!

Macbeth Spike Anchor

Replaces conventional spike *and* anchor.
Prevents creep in either direction.

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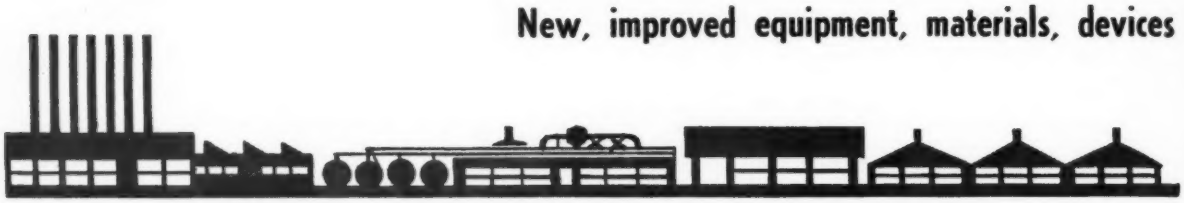
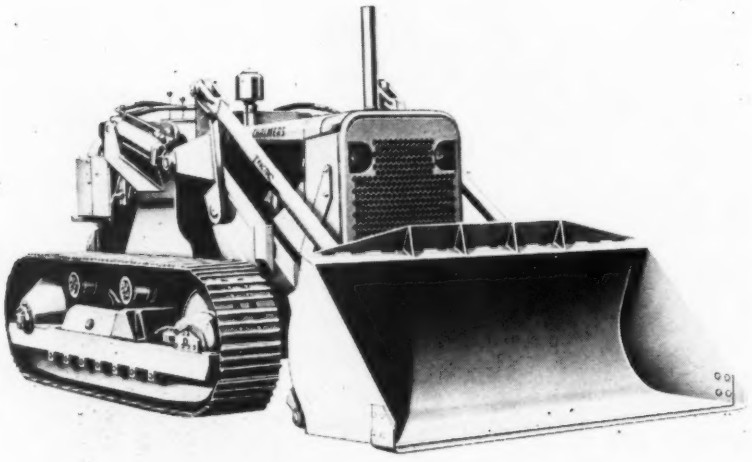


(For additional information on any of the products described in these columns, use postcards, page 995)



NEW LINE OF TRACTO-SHOVELS

THE Tractomotive Corporation, Deerfield, Ill., and the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., have jointly announced that, in addition to the Model HD-5G, three other models of Allis-Chalmers crawler tractors are now available as Tracto-Shovel units. The new models, designated as the HD-9G, the HD-15G, and the HD-20G, are similar in design to the HD-5G, but have greater capacities.

The HD-9G mounts a 2-yd. bucket and dumps at a maximum height of 11 ft. 4½ in. The HD-15G employs a 3-yd. bucket and has a dumping height of 12 ft. 8 in., while the HD-20G, which has a torque-converter drive, uses a 4-yd. bucket and dumps at a height of 13 ft. 5 in. Special buckets for handling light materials, such as snow or coal, are available for all four models. These range in capacity from 2 yd. for the HD-5G to 7 yd. for the HD-20G.

To increase the versatility of the Tracto-Shovel units, the Tractomotive Corporation is offering a variety of interchangeable attachments, including special buckets, snow plows, bulldozer blades, and rock forks, all of which can be installed in a matter of minutes.

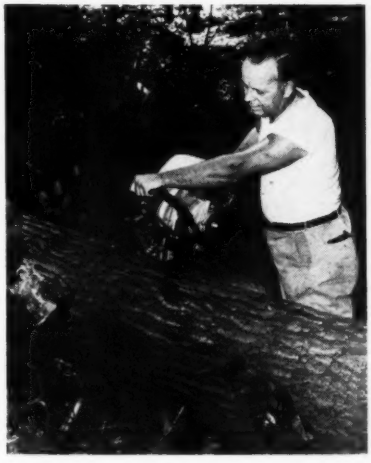
HEAVY-DUTY FENDERS FOR "CAT" TRACTOR

THE Caterpillar Tractor Company, Peoria, Ill., has announced that heavy-duty fenders are now standard equipment for Caterpillar D8 track-type tractors. The fenders are made of steel plate, ½ in. thick, and are designed to provide a more rigid platform for mounting equipment. They are also designed to withstand the rough treatment that is sometimes encountered in pioneering operations.

The heavy duty fenders are now standard equipment on the D4 tractors also, and the company anticipates that they will become so on the D7 and D6 in the near future.

IMPROVED CHAIN SAW

A NEW fast-cutting chain is the outstanding feature of an improved one-man chain saw, called the DO-101, which has been introduced by Henry Disston & Sons, Inc., Philadelphia, Pa. The new chain, which is reported to be unusually easy to sharpen, employs a comparatively small tooth with a lowered cutting edge, a shorter pitch, and a rounded guiding lug that accurately regulates the depth



of cut. Although smaller in overall size, the new cutting tooth has a greater length, thus assuring longer sharpening life.

Other features of the new saw include a sturdier crankshaft, which is said to provide a smoother, more consistent delivery of power from the unit's 3.5-hp. engine; a heavier fan housing, which is less likely to suffer damage; a rapid action stop switch; and a more conveniently located fuel-tank vent valve. The DO-101 is available in guide lengths of 20 in., 26 in., 32 in., 36 in., and 40 in.

(Turn to page 1044)

12 mile rail laid in 25 hrs.

When you're tearing up rail on a hot traffic spot such as Moffat Tunnel, you want to be mighty sure that new steel goes down again *fast*. That's why Denver, Rio Grande and Western picked a 25-ton American Locomotive Crane to handle the job.

The new rail was 133-pound stock, replacing badly worn 130-pound. It was first welded into 1600-foot sections outside the tunnel, then carried in on flat cars and welded into a continuous strip. A special cradle, designed by DRG&W, hung at the end of the crane's boom and positioned the rail for fastening. The 12.6 mile job was finished in 25 hours, without a hitch.

For such ticklish projects, and for scrap handling, bridge work, maintenance, choose your crane from the broad American line. Diesel and DiesELectric models, capacities from 25 to 80 tons. Mail the coupon for catalogs.

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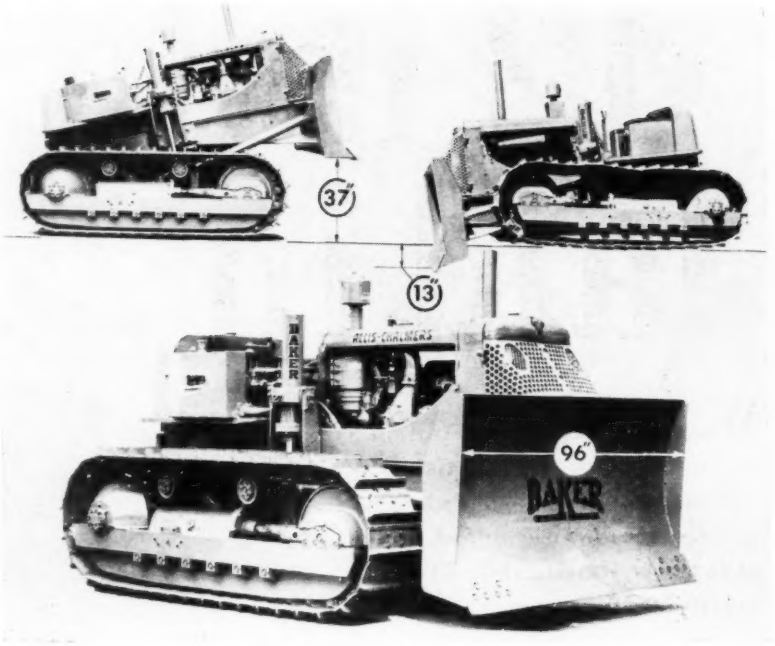
NEW BULLDOZER SANS PUSH BEAMS

WORKING in close cooperation with the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., the Baker Manufacturing Company, Springfield, Ill., has developed a new big-capacity bulldozer, called the Baker 9-X, which requires no pushbeams. Instead, the bulldozer frame is bolted directly to the tractor frame to form an integral unit. Thus the tractor frame itself becomes, in effect, the push beam. The integrated tractor-dozer is raised and lowered by double-acting hydraulic cylinders connected to the truck frame by a new type of lifting mechanism.

Designed for application to the Allis-Chalmers HD-9 tractor, the 9-X bulldozer is 8 ft. wide and weighs 3400 lb., or 1 ft. 6 in. narrower and 1150 lb. lighter than the conventional bulldozer for the HD-9 tractor. Yet the new blade has about the same total blade area and capacity as the conventional blade, and has the advantage that it can be transported over highways anytime, without permits, while the longer blade is banned from the road at night and requires a special permit for daylight transport.

In mounting the 9-X, the front spring and saddle are removed from the tractor, and the spring pads are replaced by special brackets to which the lifting mechanism is attached. This type of mounting and suspension is reported greatly to increase clearance, thereby improving operating characteristics in swampy ground. The center of gravity of the tractor, with blade attached, is said to remain well back of the second roller regardless of blade position. This feature is reported to assure maximum traction under all conditions and permits use of the tractor for drawbar work, with the blade mounted, without undue wear on the front-end truck bearings.



The new blade has a maximum rise of 37 in. above ground level and a drop of 13 in. below. The angle of approach, however, is reported to be steeper than might be expected from the 13 in. drop, because of the closer mounting of the blade to the tractor frame, which permits swinging the blade on a shorter radius than is possible with a conventional mounting.

(*Turn to page* 1046)

ROTARY BROOM

ANOTHER attachment—a rotary broom—has been developed for application to the Agricat, a diminutive crawler tractor, only 6 ft. long, distributed by Earl H. Pence & Co., Inc., San Leandro, Cal. As a result the tractor, in addition to its various other applications, can now be used for such jobs as cleaning snow or debris from walks, driveways, platforms, etc. It can also be used for cleaning the interior of cattle cars where the larger tractors cannot be maneuvered.

The rotary broom is attached to the front end of the Agricat by special shafts and is driven at speeds ranging from 120 r.p.m. to 200 r.p.m. by an auxiliary 2-hp. engine. The broom is available with either India-Palm bristles or with wire bristles.

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Ferem is used in heavy duty floors, loading platforms, corridors and runways in newly constructed buildings, or when replacing worn or eroded floors. Ferem is resistant to the corrosive action of chemical solutions—and highly slip-proof under the wet floor conditions of many industries.

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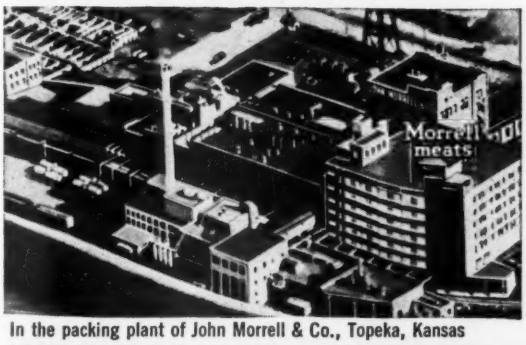
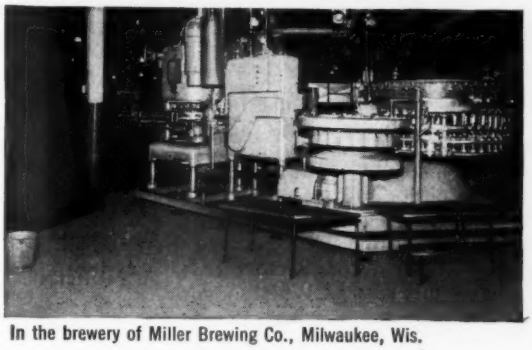


In the packing plant of John Morrell & Co., Topeka, Kansas



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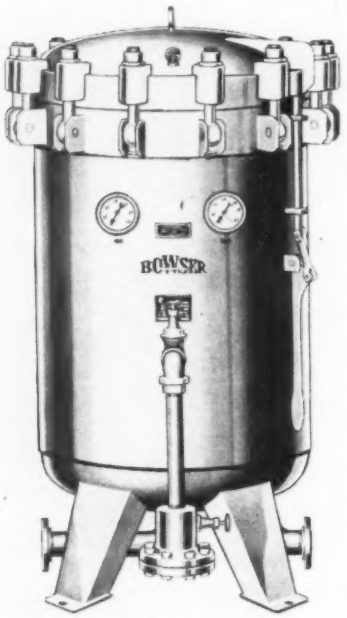
DEHYDRATOR FOR DIESEL FUELS

DIESEL engines are reported to operate with increased combustion efficiency, reduced carbon formation and less corrosion of moving parts when using fuel oil dehydrated by a new unit recently developed by Bowser, Inc., Fort Wayne, Ind. With this device free or entrained water is removed from



the fuel oil by passing the oil through elements consisting of a combination of wound cellulose cylinders, specially treated coalescing media, perforated metal and glass cloth. The unit has no moving parts, and it is said that, with reasonable care, the dehydrating elements will function indefinitely. When the unit is used at locations where the fuel oil contains unusually large volumes of water, a hydraulically balanced, automatic ejector is available as an accessory.

In actual field tests, according to the manufacturer, the dehydrator has proved highly efficient in removing moisture from liquid fuels, and it is said that small quantities or large "slugs" of water can be removed with equal ease. The dehydrator is available in capacities of 350 g.p.m., and 600 g.p.m. The maximum working pressure is 125 p.s.i.

GLASS-REINFORCED ROOFING MATERIAL

FOLLOWING a three-year research program, the Addex Corporation, Cleveland, Ohio, has announced a new method of restoring weather-worn built-up roofs. The method involves the use of a roof covering called Addex Roof-Shield, the components of which are a flexible mesh of glass fibers and chemically-treated, cold-applied liquid asphalts. The mesh is first embedded in a coating of the asphalt, then impregnated and heavily covered with another asphalt coating. The result is a heavy-duty monolithic blanket that seals the existing roof surface from parapet wall to parapet wall.

The mesh is made both of single fibers of glass and glass yarn running in random directions rather than woven in a pattern. The function of the glass mesh is comparable to that of steel rods in reinforced concrete. Its reinforcing action is reported to make possible the use of unusual thicknesses of the protective asphalts.

According to the manufacturer, Roof-Shield may be applied directly to almost any worn built-up asphalt roof with a minimum of patching and preparatory labor, even though the surface may be badly alligatored. It is reported to adhere permanently to either damp or dry surfaces, to conform closely to contours, and to become literally an integral part of the original structure. Application procedures and drying characteristics, it is said, prevent the entrapment of air or other gases. Hence, blistering or delamination is avoided.

The embedding and finishing coats of asphalt may be applied by spray or brush. The light weight of the glass-fiber mesh and the consequent ease with which it is handled is reported to reduce application costs significantly.

NET INCOME FOR 1951 REACHES $326 MILLION

Class I railroads in the first eight months of 1951 had an estimated net income, after interest and rentals, of $326,000,000, compared with $372,000,000, in the corresponding period of 1950, according to the Bureau of Railway Economics of the Association of American Railroads. The eight-months' net railway operating income, before interest and rentals, was $513,636,133, compared with $556,537,130.

Estimated results for August showed net income of $55,000,000, compared with $96,000,000 in the same month last year. Net railway operating income for the 1951 month was $80,881,476, while in August 1950 it was $122,343,180.

In the 12 months ended with August, the rate of return averaged 4.05 per cent, compared with 3.38 per cent for the 12 months ended with August 1950.

Gross in the eight months amounted to $6,762,632,765 compared with $5,885,664,117 in the same period of 1950, an increase of 14.9 per cent.

THE MONTH'S NEWS
Railway Personnel

General

G. E. Warfel, roadmaster on the St. Louis-San Francisco at Ft. Smith, Ark., has been promoted to trainmaster at Springfield, Mo.

N. S. Westergard, general roadmaster on the Spokane, Portland & Seattle, has been promoted to assistant to general manager, with headquarters as before at Portland, Ore.

Engineering

T. R. Klingel, formerly associate professor of civil engineering at the University of Minnesota, has been appointed principal assistant engineer on the Minneapolis, St. Paul & Sault Ste. Marie, with headquarters at Minneapolis, Minn.

J. S. Murphey, assistant engineer on the Illinois Central at Chicago, has been appointed assistant to division engineer of the Memphis division, with headquarters at Memphis, Tenn., succeeding **M. C. Meigs,** who has retired after 49 years of service.

Jesse R. Alcorn, who has been promoted to division engineer on the Seaboard Air Line, with headquarters at Americus, Ga., as announced in the September issue, was born at Ruffin, N. C., on July 26, 1911, and was graduated from the North Carolina State College in June 1933 with the degree of Bachelor of Science in engineering. Immediately following graduation, he entered the service of the Seaboard as an apprentice foreman at Waldo, Fla., and was employed successively as an assistant extra gang foreman, assistant to division engineer, and assistant roadmaster, until his promotion to roadmaster at Brooksville, Fla., on May 1, 1939. Mr. Alcorn served with the U. S. Army from November 1, 1943, to December 16, 1945, following which he returned to his former position

Jesse R. Alcorn

(Continued on page 1048)

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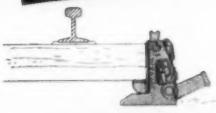

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Railway Personnel (Cont'd)

at Brooksville. On November 16, 1946, he was promoted to senior assistant division engineer, with headquarters at Jacksonville, Fla., which position he held at the time of his recent promotion.

C. A. Colpitts, engineer of track on the Canadian Pacific, has been promoted to assistant chief engineer, with headquarters as before at Montreal, Que., succeeding **R. A. Emerson,** whose promotion to chief engineer was announced in the October issue. Mr. Emerson succeeds **John E. Armstrong** whose retirement was also announced in the October issue. Succeeding Mr. Colpitts as engineer of track is **John E. Armstrong, Jr.,** assistant engineer of track.

Mr. Armstrong, Sr., was born at Peoria, Ill., on September 29, 1886, and was educated at Bradley Polytechnic Institute and Cornell University, graduating from the latter in 1908. He first entered railway service in 1901 with the Toledo, Peoria & Western at Peoria, where he served in various capacities during summer vacations. From August 1908 to August 1912 he served as an assistant on the engineering corps of the Pennsylvania, Lines West of Pittsburgh, and at the end of that period he became an assistant engineer on the Canadian Pacific at Montreal. He served in that position until May 1, 1928, when he was appointed assistant chief engineer. He was advanced to chief engineer in 1939.

John E. Armstrong

R. A. Emerson

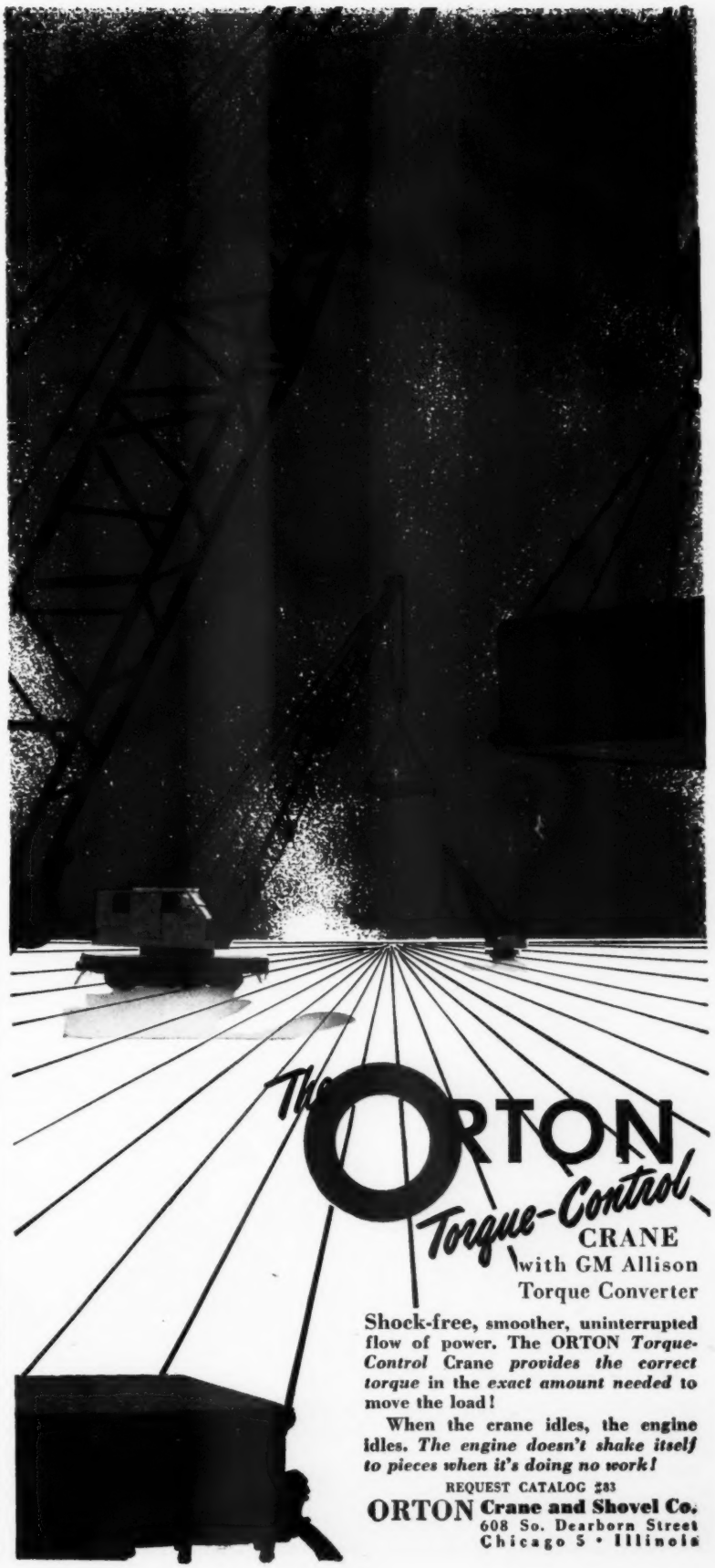
Mr. Emerson was born at Plum Coulee, Man., on April 12, 1911, and began his service with the Canadian Pacific in the engineering department in 1928, on a summer basis while attending the University of Manitoba, from which he was graduated with the degree of Bachelor of Science in civil engineering in 1930. In 1933 he was awarded one of the five Strathcona scholarships in railway transportation given annually by the graduate school of Yale university, and carried out his post-graduate studies at New Haven, Conn., in 1933 and 1934. Mr. Emerson's permanent career with the C.P.R. started in 1935, when he became a transitman at Revelstoke, B. C. One year later he was transferred to the Regina (Sask.) division. He was appointed roadmaster on the Manitoba district in 1939, and division engineer of the Brandon division in 1941, transferring to the Moose Jaw division in 1943. Mr. Emerson became assistant district engineer of the British Columbia district at Vancouver, B. C., in 1944, and was promoted to district engineer of that district two years later. In March 1948 he was appointed engineer of track of the system at Montreal and was advanced to assistant chief engineer on October 1, 1950.

Mr. Colpitts was born at Winnipeg, Man., on January 23, 1907. He attended the University of Manitoba, graduating in civil engineering in 1933. He first entered the service of the C.P.R. on July 13, 1925

(*Continued on page* 1050)

C. A. Colpitts

John E. Armstrong, Jr.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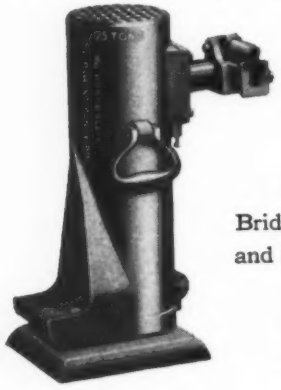

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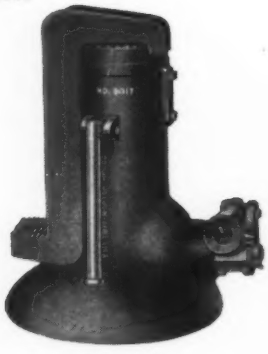

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"The House that Jacks Built"

Railway Personnel (Cont'd)

as an office boy in the Weston shops at Winnipeg and thereafter served intermittently in construction work until he completed his education. He was appointed transitman at Edmonton, Alta., in 1934 and served in that capacity at Calgary, Alta., and Winnipeg until 1941, when he was appointed roadmaster at Lloydminster, Sask. The following year Mr. Colpitts was promoted to division engineer at Saskatoon, and on July 1, 1944, he was transferred to Vancouver. He was advanced to assistant district engineer of the British Columbia district on April 17, 1949, and a year later was named district engineer at Vancouver. He was appointed engineer of track of the system in October 1950.

John E. Armstrong, Jr., was born at Cleveland, Ohio, on December 26, 1909, and was graduated from McGill university in 1933 with a degree in civil engineering. He entered the service of the C.P.R. in 1928, serving during summer vacations as a chainman and rodman. In 1934 he went with the Crawley & McCracken Company as camp inspector at various points in Ontario, and in 1936 was appointed assistant metallurgist for the Holcumb Steel Division of the Crucible Steel Company of America at Syracuse, N. Y. Mr. Armstrong returned to the Canadian Pacific in 1938 as assistant engineer at Toronto, Ont., and in 1940 was promoted to division engineer at that point, moving to Sudbury, Ont., in the same capacity four years later. He was appointed assistant district engineer at North Bay, Ont., transferring to Saint John, N. B., early this year. He was named assistant engineer of track in April.

W. C. E. Robinson, district engineer of the Ontario district of the Canadian Pacific, has been promoted to assistant engineer maintenance of way, Eastern region, with headquarters as before at Toronto, Ont. **N. M. Kelly**, assistant engineer in the vice-president's office at Toronto, succeeds Mr. Robinson.

R. M. Smith, division engineer on the Missouri Pacific at Falls City, Neb., has been promoted to district engineer, Western district, with headquarters at Kansas City, Mo., succeeding **J. R. Nagel**, who has retired after 44 years of service. Mr. Smith is succeeded by **G. M. Strawhun**, assistant trainmaster at Hoisington, Kan.

R. H. Jordan, assistant division engineer on the Erie at Hornell, N. Y., has been promoted to division engineer of the Buffalo and Rochester divisions, with headquarters at Buffalo, N. Y., succeeding **G. E. Righter**, who has retired. **E. W. Scott**, assistant division engineer at Buffalo, has been transferred to Hornell to succeed Mr. Jordan.

Hugh B. Lewis, assistant engineer in the bridge department of the Louisville and Nashville at Louisville, Ky., has been appointed assistant division engineer, with headquarters at Mobile, Ala., succeeding **G. W. Thompson**, who has retired. **Conrad W. Hale** has been appointed assistant engineer on the Louis-

For additional information, use postcard, pages 995-996

ville division, succeeding **N. C. Kieffer, Jr.**, who has been assigned to duties in the chief engineer's miscellaneous department at Louisville.

H. F. Dully, senior assistant division engineer of the Sacramento division of the Southern Pacific, with headquarters at Sacramento, Cal., has been promoted to division engineer of the Shasta division, with headquarters at Dunsmuir, Cal., succeeding **K. C. Brunner,** who has been transferred to the general office at San Francisco, Cal. Mr. Dully is succeeded by **H. W. Neuebaumer,** construction superintendent at San Francisco. **H. E. Stansbury,** assistant engineer at San Francisco, has retired after more than 47 years of railroad service.

W. R. Garner, who was recently promoted to division engineer of the Pennsylvania-Reading Seashore Lines, Atlantic division, at Camden, N. J., as noted in the August issue, was born at Spokane, Wash., on December 10, 1911, and was graduated in civil engineering from Ohio State University in 1935. He entered railway service in May, 1928, serving as a trackman on the Fort Wayne division of the Pennsylvania that summer and the following summer. After graduation in September 1935 he returned to the Pennsylvania as an engineer apprentice on the Maryland division at Perryville, Md., and in March 1936 was transferred to the office of the chief engineer maintenance of way, at Philadelphia, Pa. Mr. Garner was promoted to assistant on the engineering corps at Hollidaysburg, Pa., in June 1936 and served in that capacity and as assistant supervisor of track at various points until February 1941 when he was promoted to supervisor of tracks at Cincinnati, Ohio, being transferred to Terre Haute, Ind., in March 1942 and to Harrisburg, Pa., in December 1944. He was advanced to assistant division engineer at Harrisburg in 1949, and served in that capacity until his recent appointment.

C. H. Kooser, whose promotion to division engineer on the Pennsylvania at Buffalo, N. Y., was noted in the July issue, was born at Manor, Pa., and received a Bachelor of Science degree in civil engineering from the University of Pittsburgh in 1926. He first entered the service of the Pennsylvania as a clerk in the station department in 1918 and later served as laborer, assistant signalman and crane fireman while completing his education. He became an engineer apprentice on June 7, 1926, and was advanced to assistant supervisor of track on January 1, 1928, in which capacity he served at Buffalo, N. Y., and Trafford, Pa. Mr. Kooser was promoted to supervisor of track at Monongahela City, on July 1, 1927, and later served at Niles, Ohio and Cambridge. Between April 1, 1934, and February 1, 1938, Mr. Kooser was assigned to a number of special projects in connection with the Pennsylvania's electrification program and subsequently was in charge of the operation of the Sperry car over the system. He became supervisor of track at Northumberland, Pa.,

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Railway Personnel (Cont'd)

on July 1, 1943, and was transferred to Mansfield, Ohio, on March 16, 1945. He was advanced to assistant division engineer of the Philadelphia Terminal division at Philadelphia, Pa., in 1950, which position he held until his recent appointment.

Track

S. Martyniuk, section foreman on the Canadian Pacific at Neilburg, Sask., has been promoted to assistant roadmaster on the Wilkie subdivision, with headquarters at Perdue, Sask.

E. P. Straughan, roadmaster on the Spokane, Portland & Seattle at Pasco, Wash., has been promoted to general roadmaster, with headquarters at Portland, Ore., succeeding **N. S. Westergard,** whose promotion to assistant to general manager is announced elsewhere in these columns.

Claude A. Peebles, Jr., acting assistant roadmaster on the St. Louis-San Francisco at Springfield, Mo., has been promoted to roadmaster at Ft. Smith, Ark., succeeding **G. E. Warfel,** whose promotion to trainmaster is announced elsewhere in these columns. Mr. Peebles entered Frisco service in February 1949 as a student apprentice at Ft. Scott, Kan. He was transferred to Springfield in March 1950 and appointed acting roadmaster there in January 1951.

Lee Porter, formerly assistant track supervisor on the Chicago & Eastern Illinois, has been appointed roadmaster on the Chicago, Rock Island & Pacific, with headquarters at Clay Center, Kan., succeeding **G. O. Harmon,** who has been assigned to other duties.

Returning from military service, **H. O. Stratton** has been appointed assistant supervisor of track on the Pennsylvania at Wilmington, Del., succeeding **F. R. Matthews,** who has been transferred to York, Pa., where he replaces **F. H. Ford, Jr.,** who has been appointed junior engineer on the Maryland division. **J. E. Scott,** junior engineer on the Maryland division, has been promoted to assistant supervisor of track at Aspinwall, Pa., succeeding **L. E. Williams, Jr.,** who has been transferred to Johnstown, Pa. **H. D. Tietjen,** junior engineer on the Columbus division, has been promoted to assistant supervisor of track at Williamsport, Pa.

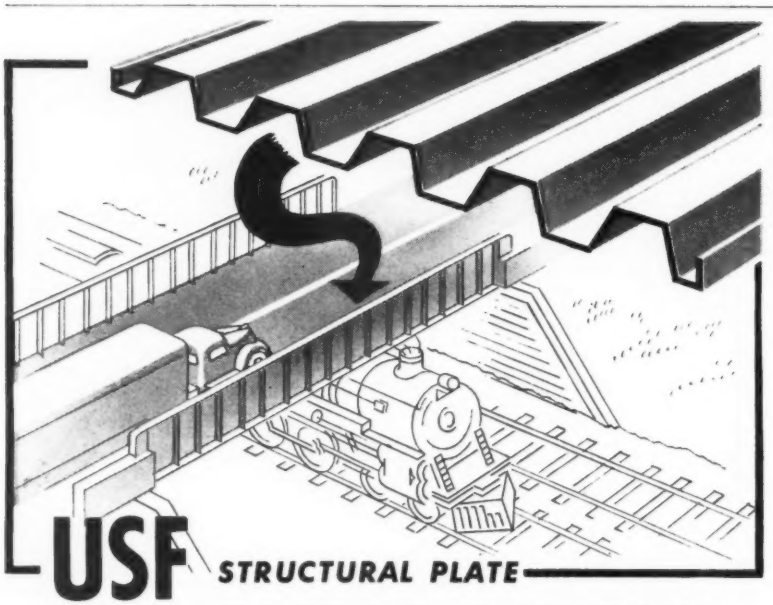
James M. Peek, assistant track supervisor on the Southern at Greenville, S. C., has been promoted to track supervisor at Keysville, Va. **Edward S. Cole** has been appointed assistant track supervisor at Birmingham, Ala.

Mr. Peek was born at Blacksburg, S. C., on February 3, 1922. Beginning his service with the Southern as a rodman at Charlotte, N. C., in April, 1942, he was furloughed for military service later in that year and returned to the railway at Charlotte in June 1948. He was made a student apprentice at Columbia, S. C., in November 1948 and was appointed assistant supervisor at that location in May 1950. He was transferred to Greenville the following August.

Clyde E. Geedey, whose promotion to supervisor of track on the Pennsylvania, with headquarters at Buttonwood, Pa., was announced in the September issue, was born in Juniata County, Pa., on November 27, 1909. He entered the service of the Pennsylvania as a laborer at Mifflin, Pa., on September 7, 1926, and in 1934 was appointed machiner operator, subsequently serving as foreman and general foreman. He was promoted to assistant supervisor of track in 1944, which position he held at the time of his recent promotion.

Joseph S. Kay, who has been appointed supervisor of track on the Pennsylvania at Cleveland, Ohio, as reported in the September issue, was born at Beaver Falls, Pa., on December 26, 1907. Entering the employ of the Pennsylvania on April 9, 1925, as a trackman at Rochester, Pa., he subsequently served at that location until April 1943 when he was appointed general foreman at the Canton yards. In July 1948 Mr. Kay was promoted to assistant supervisor of track at Cleveland, and was transferred to Dennison, Ohio, in October 1948, where he remained until he received his recent promotion.

E. L. Clausing, whose promotion to supervisor of track on the Pennsylvania



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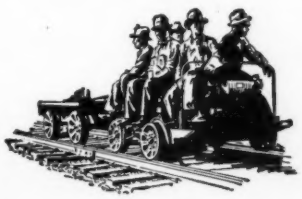
at Logansport, Ind., was announced in the July issue, was born at Rising Sun, Ind., on February 27, 1924, and was graduated from the University of Notre Dame with the degree of Bachelor of Science in civil engineering in June, 1947. He entered the service of the Pennsylvania as a chainman at Colehour, Ind., in July 1946. In February 1947 he was appointed an engineering apprentice at Crestline, Ohio, and in July of that year was transferred to Greenville, Ill. Mr. Clausing was advanced to assistant supervisor of track at York, Pa., in January 1948. The following May he was transferred to Derry, Pa.

Harold L. Mitchell, whose appointment as supervisor of track at Subdivision 25, Ohio Central division, of the New York Central at Charleston, W. Va., was announced in the August issue, was born at Sandy Lake, Pa., on May 19, 1902. He entered the service of the New York Central on March 6, 1920, as a laborer at Polk, Pa. Subsequently he served at various locations as section foreman and extra gang foreman. In April 1941 he was appointed general foreman at Franklin, Pa., and two years later was advanced to assistant supervisor of track at Franklin, in which capacity he later served successively at Ashtabula, Ohio, Dunkirk, N. Y., and again at Franklin. He remained at the latter location until his recent promotion.

Peter N. Kulick, who, as announced in the September issue, has been appointed supervisor of track on the Pennsylvania, with headquarters at Carnegie, Pa., was born at Gurnee, Ill., on November 6, 1924, and was graduated from the University of Illinois with a degree of Bachelor of Science in general engineering in June 1947. On July 1 of that year he entered the service of the Pennsylvania as an apprentice engineer at Indianapolis, Ind., and on September 15 was appointed junior engineer at Morrow, Ohio, subsequently serving in that capacity at Columbus, Ohio, and Kalamazoo, Mich. Mr. Kulick was advanced to assistant track supervisor at Williamsport, Pa., on July 15, 1948. On March 15, he was transferred to Mansfield, Ohio.

James H. Crenshaw, whose appointment as general roadmaster of the Atlantic Coast Line with headquarters at Rocky Mount, N. C., was noted in the September issue, was born in Lancaster County, S. C., on September 14, 1900. He first entered railroad service with the Seaboard Air Line on August 1, 1917, as a laborer on the Georgia division. During the period from October 1917 to October 1945 he served successively as assistant foreman, foreman, acting roadmaster and roadmaster. In November of the latter year, he went with the A.C.L. as a foreman on the Northern division, and was promoted to roadmaster on August 12, 1947. Mr. Crenshaw served in the latter capacity until his recent advancement.



Bridge and Building

Charles H. Newlin, assistant engineer on the Southern at Knoxville, Tenn., has been appointed bridge and building supervisor at Bristol, Va.

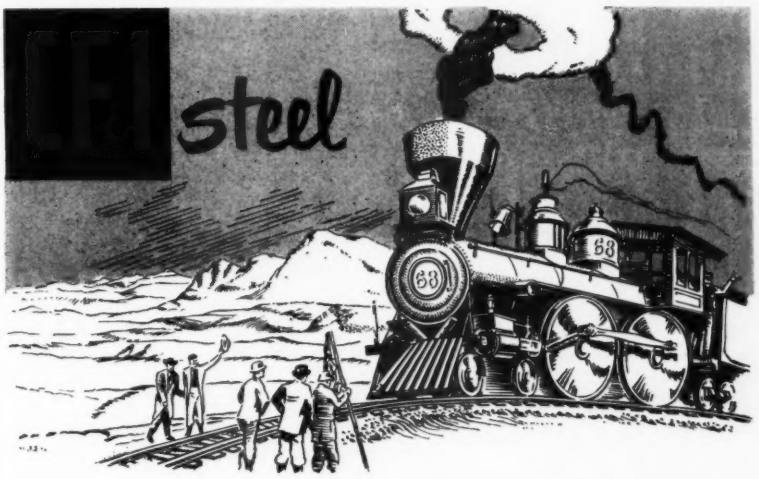
H. L. Chamberlain, junior engineer on the Panhandle division, has been promoted to assistant supervisor of structures at Grand Rapids, Mich., succeeding **C. A. J. Richards,** who has retired.

Obituary

Charles W. Burke, chief engineer maintenance of way of the New York City Board of Transportation, died recently at the age of 66.

A. J. Rothwell, retired bridge and building master on the Canadian National, died recently at New Westminster, B. C., at the age of 73.

George B. McMillen, depreciation engineer on the Illinois Central at Chicago, died recently. Born at Mt. Sterling, Ill., on August 21, 1890, Mr. McMillen started his railroad career in 1920 with the Chicago & North Western. His service with the I. C. began in 1923.



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Association News

American Railway Engineering Association

The most important events on the agenda of the association for this month are meetings of the Nominating committee and the Board of Direction, which will meet on the same day, November 9, and of the Arrangements Committee, which will hold a meeting at association headquarters, Chicago, on November 8.

Bridge and Building Association

A two-day meeting of the Executive committee has been scheduled by President Guy Martin to be held at the St. Charles Hotel, New Orleans, La., on December 4-5. Aside from routine business it is planned at the meeting to select the personnel of the committees that are to prepare technical reports for presentation at the 1952 convention. Postcards were mailed from the secretary's office on October 15 to all members of the association requesting them to indicate the committees on which they would like best to serve. These cards, as

Meetings and Conventions

American Railway Bridge and Building Association—Elise LaChance, Secretary, 431 S. Dearborn street, Chicago 5.

American Railway Engineering Association—Annual Meeting, March 11-13, 1952, Chicago. Neal D. Howard, Secretary, 59 E. Van Buren street, Chicago 5.

American Wood-Preservers' Association—H. L. Dawson, Secretary-treasurer, 839 Seventeenth street, N. W., Washington 6, D. C.

Bridge and Building Supply Association—L. R. Gurley, Secretary, 201 North Wells street, Chicago 6.

Maintenance of Way Club of Chicago—Next meeting November 26. E. C. Patterson, Secretary-treasurer, Room 1512, 400 W. Madison street, Chicago 6.

Metropolitan Maintenance of Way Club—Secretary, 30 Church street, New York.

National Railway Appliances Association—Robert A. Carr, Secretary, 310 South Michigan avenue, Chicago 4; Lewis Thomas, Assistant Secretary, 59 East Van Buren street, Chicago 5.

Railway Tie Association—Roy M. Edmonds, Secretary-treasurer, 912 Shell Building, St. Louis 3, Mo.

Roadmasters' and Maintenance of Way Association of America—Elise LaChance, Secretary, 431 S. Dearborn street, Chicago 5.

Track Supply Association—Lewis Thomas, Secretary, 59 E. Van Buren street, Chicago 5.

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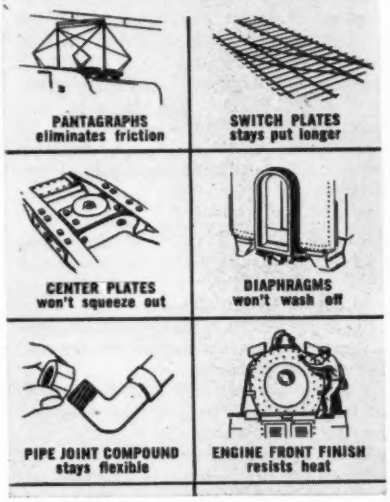
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returned by association members, will be on hand at the December meeting of the Executive committee for its guidance in selecting the committee personnel.

Roadmasters' Association

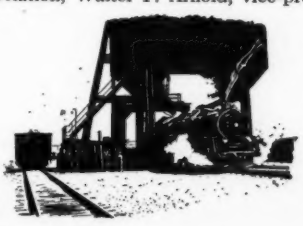
President A. H. Whisler has called a meeting of the Executive committee to be held at the Engineers' Club, Chicago, on December 11. The principal item of business on the agenda of the meeting will be the selection of personnel for the technical committees that are to prepare reports for presentation at the 1952 convention. On October 15 postcards were mailed out from the secretary's office, listing the subjects to be investigated and requesting members to indicate those committees on which they desire most to serve. As filled out and returned by members, these cards are expected to be available for the guidance of the Executive committee in selecting personnel of the technical committees at the December 11 meeting.

Maintenance of Way Club of Chicago

The first meeting of the current season was held at Eitel's restaurant in the Field Building on October 22. The program consisted of a panel discussion of the subject "Trends in Track Maintenance Organizations—And Why," the panel consisting of two speakers. These were E. L. Anderson, chief engineer, St. Louis-San Francisco, Springfield, Mo., and J. B. Fitzgerald, engineer maintenance of way, Chicago, Rock Island & Pacific, Chicago. On both of these roads the basic organization of the track maintenance forces has recently been extensively revised to minimize the role of the section gangs and to place the heavier maintenance operations in the hands of larger gangs with more territory, the purpose being to counteract rising labor costs. The details of the revised organizations on their respective roads and the economies being effected by them were described by Messrs. Anderson and Fitzgerald. The nature of the new system that has been introduced on the Frisco was described in the September, 1951, issue of *Railway Engineering and Maintenance*, page 810.

Railway Tie Association

The Railway Tie Association held its thirty-third annual convention at the Netherland Plaza Hotel, Cincinnati, Ohio, September 26-28. The attendance totaled 352 members and guests, of whom 99 were railroad men. The meeting was directed by the president of the association, Walter P. Arnold, vice-president, Koppers Company, Pittsburgh, Pa.



A considerable number of addresses were presented of direct interest to railroad men. Among these, Dr. Julius H. Parmelee, vice-president and director, Bureau of Railway Economics, Association of American Railroads, spoke on "Prospective Railroad Earnings and Expenditures"; John E. Tilford, president, Louisville & Nashville, on "The Railroad Outlook"; W. G. Powrie, chief engineer, Chicago, Milwaukee, St. Paul & Pacific, on "100 Years of Ties on the Milwaukee"; L. L. Adams, chief engineer, Louisville & Nashville, on "Test of Methods to Prolong Service Life of Ties in Track"; M. G. Kirk, Pittsburgh Screw & Bolt Corp., on "Service Life of Doweled Ties"; and Paul D. Brentlinger, forester, Pennsylvania, on "Problems of Procurement of Crossties."

In addition, the subject of banding of crossties was covered in two papers, one by F. S. Shinn, assistant tie and timber agent, Nickel Plate, entitled "Our Experience With Banding," and the other by F. E. Houck, manager of sales, Steel Strapping Division, Brainard Steel Company, entitled "Savings to be Effected By Banding." Also, four addresses were devoted to the subject of hickory crossties, including one by W. E. Kemp, superintendent, Norfolk & Western treating plant, Norfolk, Va., entitled "Experiences of the N.&W."; one by Buford Holley, T. J. Moss Tie Company, en-

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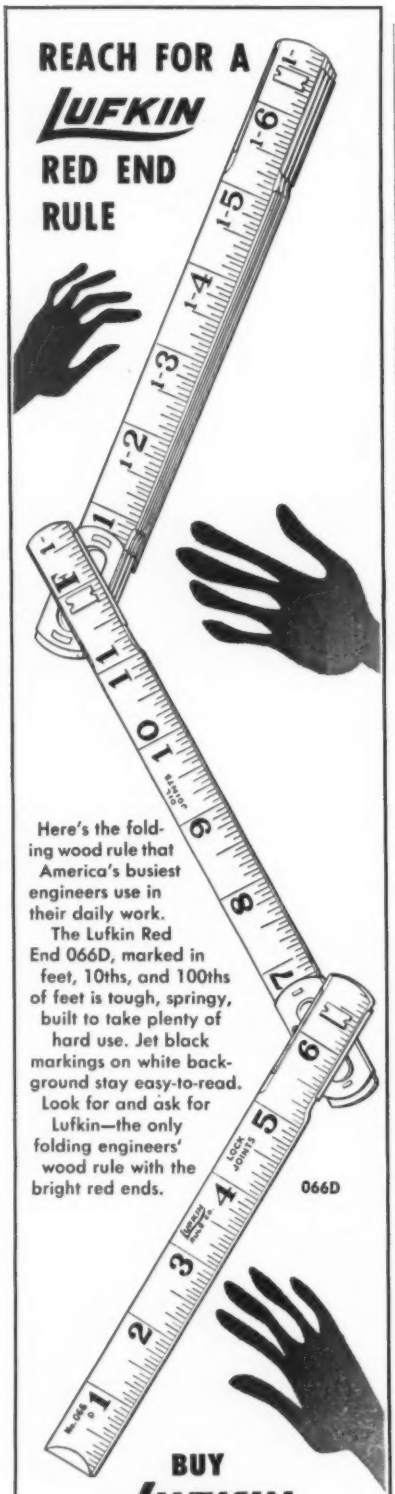
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Association News (Cont'd)

titled "More Use of Hickory Ties from the Standpoint of Conservation"; a third by Dr. George H. Englerth, Southeastern Foresty Experiment Station, U.S. Dept. of Agriculture, entitled "What the Record Reveals On the Use of Hickory"; and the fourth by Monie S. Hudson, Taylor-Colquitt Company, entitled "Vapor Drying Hickory Ties."

Committee reports of particular interest to users of crossties were those of the Committee on Checking and Splitting of Crossties, of which J. A. Vaughan, Southern Wood Preserving Company was chairman; on Mechanical Handling of Crossties, of which M. L. Wilson, Kirby Lumber Corporation, was chairman, and on Timber Conservation, of which D. B. Mabry, T. J. Moss Tie Company, was chairman.

In the election of officers, W. J. Chambliss, Jr., Bond Bros. Louisville, Ky., was advanced from first vice-president to president; Harry Dunstan, Southern Wood Preserving Company, Atlanta, Ga., was elected first vice-president; J. E. Peterson, Gross & Janes Co., St. Louis, Mo., was elected second vice-president. Elected to the Executive committee were Mr. Hudson; Meyer Levy, T. J. Moss Tie Company, St. Louis, Mo.; Gilbert Callicott, Potosi Tie & Lumber Co., St. Louis; and Frank Campbell, Jr. W. B. Crane Company, Chicago. Roy M. Edmonds was re-elected secreatry-treasurer by the Executive committee.

Supply Trade News

General

The **Flintkote Company,** New York, has appointed the **Ellcon Company,** 30 Church street, New York, as special manufacturer's sales representatives to the transportation industry for Flintkote products in the eastern section of the United States.

Personal

Sid A. Skidmore, Jr., has been appointed assistant chief engineer of the P. & M. Co., with headquarters at Chicago.

Alfred C. Laessig and **Erling Wessel** have both been elected members of the board of directors of **Hubbard and Company,** Pittsburgh, Pa.

H. V. Rasmussen has been appointed executive engineer at the Wellsville, N. Y., plant of the **Worthington Pump & Machinery Corp.**

The **Timken Roller Bearing Company,** has announced the appointment of **George T. Humphrey, Jr.,** to the post of assistant general manager of the Service

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S. A. Rishovd, whose promotion to vice-president of the Northwestern Motor Company at Eau Claire, Wis., was announced in the October issue.

Sales division, with headquarters at Canton, Ohio. Mr. Humphrey was formerly assistant branch manager of the Service Sales division at Dallas, Tex.

The **Townsend Company,** New Brighton, Pa., has announced the appointment of **H. E. Chilcoat** as assistant general sales manager. Mr. Chilcoat has been manager of the railroad sales department for the past three years, and in addition to his new duties will continue to have direct charge of all sales to railroads.

Carl A. Ten Hoopen has been appointed Pacific Coast sales manager of the Cyclone Fence division of the **American Steel & Wire Co.,** a **U. S. Steel Corporation** subsidiary. He succeeds **Raymond G. Russell,** who has retired.

Arthur I. Gibson has been appointed manager of the newly formed sheet and strip division of the general sales department of **United States Steel Supply Company.** He was formerly product representative for the company's sheet and strip division in Pittsburgh, Pa.

L. K. Stringham has been appointed chief engineer for the **Lincoln Electric Company** of Cleveland. **G. G. Landis** will continue as engineering vice-president. Mr. Stringham was graduated from Cornell University as an electrical engineer and joined Lincoln Electric in 1933. He has worked continuously in the engineering department and for the past two years has been director of welding development.

Ralston B. Reid has been appointed an assistant manager of the advertising and sales promotion department of the apparatus marketing division of the **General Electric Company.**

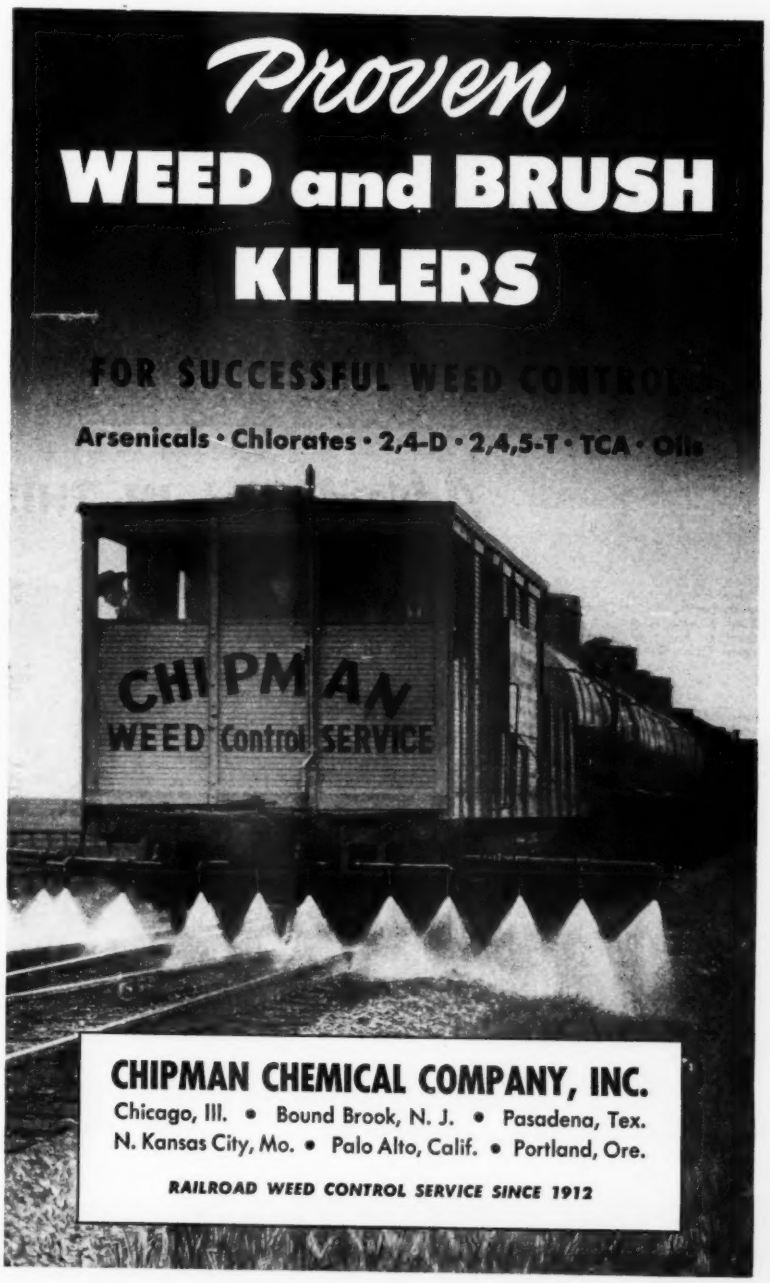
Charles E. Wilson, sales vice-president of the **Worthington Pump & Machinery Corp.,** has been appointed a West Coast consultant on sales problems. Mr. Wilson retired from his former position and activities in corporation affairs on October 1, but will continue in a consulting capacity at Worthington's offices in Los Angeles, San Francisco, Seattle and Salt Lake City.

Obituary

Edwin L. Hettinger, for more than 30 years director of optical research at Willson Products, Inc., died on September 2 at the age of 72.

C. L. Best, one of the founders of the Caterpillar Tractor Company, and chairman of its board and a member of its executive committee, died in San Francisco on September 22, at the age of 73. When he was 18, Mr. Best was named buyer for his father's factory, the Best Manufacturing Company, and by the time he was 20, he was superintendent. Mr. Best continued as president of this firm until 1925, when it and the Holt Manufacturing Company were merged to form the Caterpillar Tractor Company. Mr. Best became chairman of the board of the new organization.

Mrs. Ida R. Simmons, a director of the Simmons-Boardman Publishing Corporation, publishers of *Railway Engineering and Maintenance,* died on September 20 at her home in New Rochelle, N. Y., at the age of 66. Mrs. Simmons was a former employee of the publishing company, having joined its service while still in her 'teens. In 1914 she was married to the late Colonel Edward A. Simmons, then president of the company. Following his death in 1931, she was elected a member of the directorate.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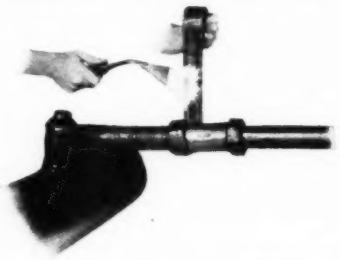

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Caterpillar Tractor Co. 987
Chipman Chemical Company, Inc. 1057
Colorado Fuel and Iron Corporation, The ..1053
Cullen-Friestedt Co. 1056

D

Dearborn Chemical Company 999
Dixon Crucible Company, Joseph 1054
Dow Chemical Company, The 973
Duff-Norton Manufacturing Co., The 1050

E

Eaton Manufacturing Company 962
Electric Tamper & Equipment Co. 1059

F

Fairbanks, Morse & Co. 1004
Fairmont Railway Motors, Inc. 1002

G

Gardner-Denver Company 976
General Chemical Division 991

H

Horn Company, A. C. 1045

I

Industrial Brownhoist Corporation 965
Ingersoll-Rand Company 972

K

Kennedy Company, Inc., H. T. 1041
Keuffel & Esser Co. 1054
Koehring Company 985

L

Layne & Bowler, Inc. 986
LeTourneau, Inc., R. G. 966-967
Lewis Bolt & Nut Company 979
Lufkin Rule Co., The 1056

M

Massey Concrete Products Co. 986
Matisa Equipment Corp., The 997
Moss Tie Company, T. J. 989

N

National Lock Washer Company, The 961
Nordberg Mfg. Co. 978
Northwestern Motor Company 1051

O

Onan & Sons, Inc., D. W. 988
Orton Crane and Shovel Co. 1049
Oxweld Railroad Service Company, A Division of Union Carbide and Carbon Corporation 980

P

Pacific Coast Borax Co. 1047
Pence & Co., Inc., Earl H. 988
Pittsburgh Plate Glass Company 1001
Pullman-Standard Car Manufacturing Company 975

Q

Q and C Company, The 990

R

Racine Tool and Machine Company 977
Rail Joint Company, Inc., The 974
Railroad Products Co. 984
Rails Company, The 968
Railway Track-work Co. 982
Reade Manufacturing Company, Inc. 1039

S

Schramm Inc. 969
Service Supply Corporation 1055
Simmons-Boardman Publishing Corporation 970-986-988-992
Speno Railroad Ballast Cleaning Co., Inc., Frank 984

T

Tapecoat Company, The 1058
Templeton, Kenly & Co. 1048
Texas Company, The 1060
Timken Roller Bearing Company, The 971
True Temper Corporation 981
Tuco Products Corporation 988

U

Union Carbide and Carbon Corporation, Oxweld Railroad Service Company 980
United Steel Fabricators, Inc. 1052

V

Viking Pump Company 990

W

Wisconsin Motor Corporation 982
Woolery Machine Company 964

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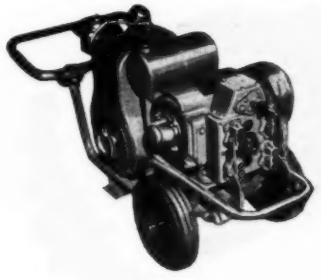

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